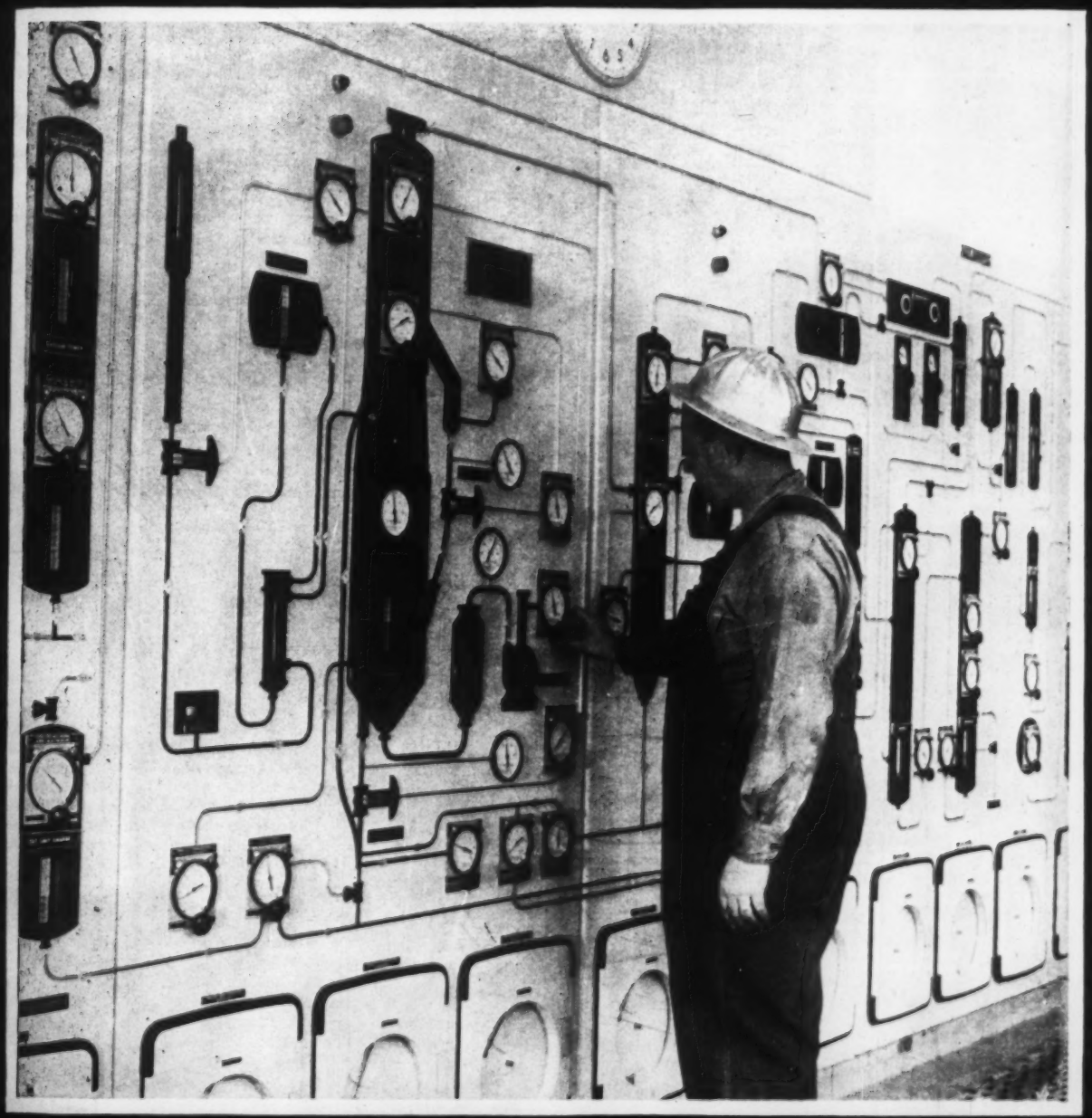
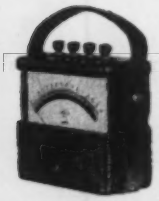
Instruments

[E MAGAZINE of MEASUREMENT and CONTROL

Vol. 22 OCTOBER 1949 No. 10

luding the JOURNAL of the Instrument Society of America





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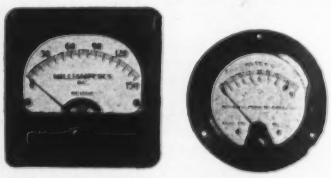

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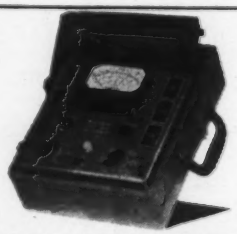

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EDITORIAL: An old timer's notes on the Fourth Annual Instrument Conference and Exhibit, St. Louis, Mo., Sept. 12-16, 1949, under the auspices of the ISA, with ASME, AIEE, AIP, IRE, SAMA, and NTF participating.

Keynote, Productivity; Mood, Earnestness

Jefferson Hotel, St. Louis
Friday night, September 16th

"MONDAY the 12th to Friday the 16th"—that's five days; but for many it's a ten- or twelve-day stay. When we arrived on Thursday the 8th the hotel lobby swarmed with members; and, earlier that day, many passengers on the Constellation had been instrument men, two of them from Holland! Of course, a few of this year's 5660 registrants could not stay the full five days; but some officials and exhibitors who arrived Tuesday the 6th may remain over Sunday the 18th; so the average length-of-stay of the 5660 must be five days plus . . . Talk about enthusiasm!

* * *

Enthusiasm, yes—as at every previous Conference and Exhibit; but that word doesn't adequately describe what's in the air this year. There's less vague curiosity and more "target-seeking-missile" search for optimal solutions of specific problems, mostly related to production. There's less relaxation or casualness and more exertion or determination—oh, not to the point of grim aching concentration but . . . well, it would seem that the *mot juste* is Earnestness.

Earnestness, intentness, thirst for knowledge—that's the impression we carried away after dropping in on the ten classrooms of the Mechanics' Clinic held September 9, 10 and 11. Every classroom overflowed, because plans had been made for a total of 120 (twelve to each class) but 195 registered and 171 ATTENDED ALL TEN PERIODS from Friday afternoon to Sunday evening. We're told that thirteen registrants joined the ISA during the Clinic. Another fact worth noting: we recognized among the "mechanics" one Department Head and several engineers, physicists and chemists who came to get their hands on the demonstration instruments and components. Congratulations to the patient, courteous, untiring and highly-competent instructors:

William Kehoe, Anthony Costa, Louis Hickman (American Meter); V. S. Rutherford (Bailey Meter); M. D. Shriver (Bristol); Malcolm Hall (Foxboro); James L. McFadden (Gow-Mac); R. L. Wham, A. A. Degling, J. E. Casey, L. E. Jewett (L&N); E. M. Dederer, A. Colonnese, R. J. Ingham (M,M&M); W. L. Eckdhal, R. Benninghoven (Republic); George E. Howard (Taylor); Bruno Ramthun, Conrad Claeson (Wheelco).

* * *

[Bull sessions all enjoyable, as always; those in the Auditorium specific—instruments; those in hotels general—technology, industry, etc.; and one on the *SS Admiral* (thanks to Phil Swain, John Leslie and Bill Bowman) solved some problems of All Mankind.]

At bull sessions, the oldest topics seem to arouse the widest interest. For example the idea of classifying (a) all instruments, (b) all instrument occupations and (c) all instrument men into (1) optical, (2) mechanical and (3) electrical. When this topic came up, much of the discussion reminded us, almost word-for-word, of a seminar of instrument-making apprentices and their instructors in New York in the winter of 1904-05.

This basic classification is still excellent today, in spite of what has happened in 45 years, in spite of the great UNIFICATION resulting from the early formulation of the science of Instrumentation in the nineteen-twenties. This consisted in classifying measurables, classifying utilizable principles, classifying measuring elements, classifying recording and integrating systems, classifying amplifying systems, classifying control systems—yes, but it also consisted in discovering, naming and explaining what the most diverse elements and systems have IN COMMON: their static, kinematic and dynamic properties, characteristics and behaviors. It is as a UNIFYING science that Instrumentation has made possible the faster responses, the more accurate measurements, the closer control and the minimization of hunting which, in turn, make possible our high standard of living.

Chemists—and lots of others—fascinated by the exhibits of new spectrochemical instruments. Sales reported "heavy." Can it be that $20,000 to $60,000 instruments are bought by the dozen? Why not, when they save dozens of man-years?

A few decades ago, only the visible spectrum was known; emission and absorption lines just discovered; multiplets unsuspected; industrial plant people left spectroscopes to "pure scientists." Today, industrialization of spectroscopy extends from x-rays to radio waves—not to mention ions. A high-resolution picture of the entire instrumentally-resolvable spectrum would be a mile long. *A propos* of resolving power: what was one thin hump with previous methods is now recorded as a quintuplet by the pen of the Geiger-counter-type x-ray spectrometer on display—and all five line intensities are measurable to five percent accuracy!

For process-control men, an irresistible attraction on the exhibit floor was a "graphic panel" generally similar to the one installed a few weeks ago at the Rock Island Refining Co. near Indianapolis. Interest in this "new-look" centralization was so strong, even before the exhibit opened, that scores of men flew, drove and rode from St. Louis to Indianapolis on Sunday the 11th after Dave Boyd, at their request, had phoned L. E. Winkler on Saturday to arrange for this visit.

Centralization was a frequent bull-session topic. Some subscribers asked if the "graphic panel" was what had been predicted for 1949 on the December 1948 editorial page. The answer is no, for the prediction read as follows:

The small quick-review and quick-action instrument which does to an array of instruments what is done today by the human being who uses such an array as one complex but coordinated means. We are not predicting "master controllers": they have already been designed for several arrays. What we predict is an instrument which will:

(1) make immediate "joint" or "integrated" reports on the time functions of the readings of the numerous already-installed measuring AND automatic-control instruments; and

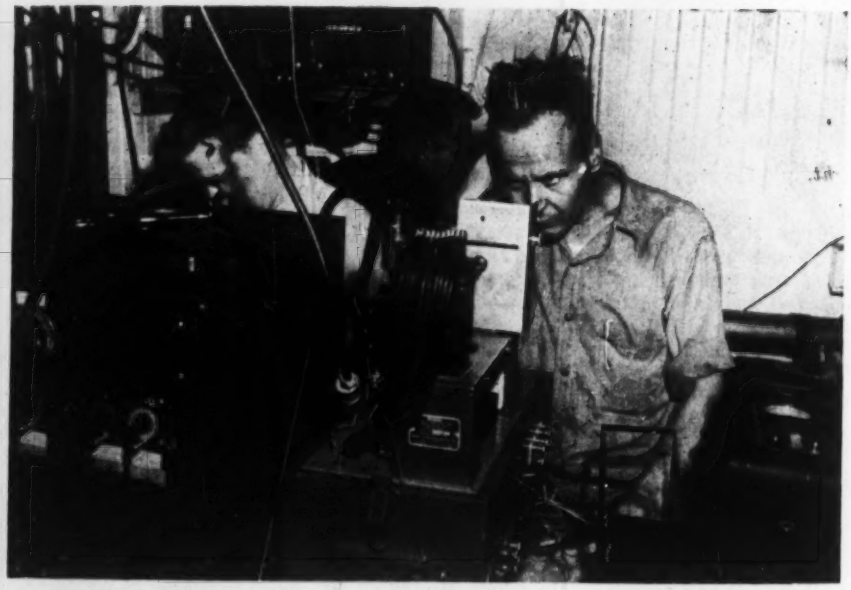
(2) immediately carry out IN DETAIL the logical BROAD decisions of the human supervisor.

However, these panels help make the prediction come true sooner: by prefiguring what had been suggested since 1940 under such titles as "Automatize Quality Control" and with hints that almost blueprinted the PRODUCT-QUALITY CONTROLLER commanding the temperature, flow-ratio, pressure and other controllers so that its "application" will not be one process but a series of processes . . . such as an entire refinery!

At the Auditorium we were asked a million times—well, ten or fifteen times—to name THE outstanding innovation. As at every previous show, the obvious answer was—and is—that twenty companies are tied for first place; all showing wonderful new devices but none a true "innovation" because their utilized principles had been disclosed previously. But this year some questioners went on: "I don't mean the commercial exhibits; I mean disclosures in technical papers; you've got all preprints; what do you say?" Our answer: "Probably the only prime disclosure of a true innovation is by Bill Wildhack of the NBS. He announces a genuinely novel principle (remarkable because based on the well-known gas laws) and his novel gadget, being shown to the public for the first time at the Bureau's booth, is—believe it or not—a thermometer and flowmeter and pressure gage and hygrometer and gas analyzer and a couple of other instruments, depending on how you set it up!"

Pleasant memory: that when we sat in *Instruments*' booth, passers-by stopped to introduce themselves as old faithful subscribers. Said one enthusiastic Californian: "I'm boiling mad! A group of young highbrows in our lab want to be called the Cybernetics Group because they design control systems for self-propelled missiles. I'm mad because they laughed when I told them that Instrumentation is the science of measurement AND control. Can't you people do something about it?" Our answer: "No; and you're not half as mad as are some highbrows when they're told they were anticipated by the 'practical men' they spurn and belittle. Since you're 'only' an engineer, you'll incur their enmity if you try to enlighten them. As they grow older they'll acquire wisdom and tolerance—and they might even join the ISA!"

—M. F. BEHAR



Watching the oscillograph during seismic reflection work on board the Atlantis. It is clear that space is not over-abundant.

Principal Instrumentation Problems of Deep-Sea Oceanographic Exploration*

By C. O'D. ISELIN, Director, Woods Hole Oceanographic Institution, Woods Hole, Mass.

OCEANOGRAPHY, as indeed are most of the other subdivisions of the earth sciences, is still a relatively undeveloped subject. It is somewhat embarrassing to me to have to emphasize at the outset how little we know about the oceans, although they cover more than two-thirds of the earth's surface.

The reasons for the backwardness of the earth sciences, in contrast to the laboratory sciences, are not hard to find. The universities have long encouraged the laboratory sciences and to a lesser degree they have supported those phases of the earth sciences that can be worked on indoors; but it has seemed both inconvenient and expensive to study nature outside the laboratory: students and instructors have schedules of fixed engagements. Furthermore, the relatively inexact nature of the non-laboratory investigations has not appealed to our best scientists. However, as I shall try to indicate, it is becoming increasingly clear that this lack of balance of knowledge has been a mistake. There are many practical applications to oceanography, especially in time of war, but perhaps more important is the fact that oceanography has become the bottle-neck in the advance of other aspects of the earth sciences, particularly in meteorology and in geology.

It may well be asked why it is that we have come to consider oceanography as a proper subdivision of science, for under this term we usually include all scientific aspects of the seas: their physics, their chemistry, their geology and their biology. Under oceanography, we are trying to deal with all the scientific aspects of a particular environment. What in addition ties oceanography together is that whatever problem of the sea one may attack, sooner or later one must take into account the movements of the water. Lacking an understanding of its circulation, it is difficult to advance knowledge concerning other phases of the marine environment. Furthermore, there is the practical question that once you have a sea-going research vessel that is properly equipped, she should be used as efficiently as possible to gather data for the advancement of as many problems as possible. The oceanographer, if he is any good, becomes skillful in handling instruments at sea, in setting up profitable experiments at sea, and in doing his thinking on shipboard rather than after the voyage has been completed and the mistakes can no longer be corrected. Most laboratory trained scientists find it difficult to adjust themselves to these aspects of oceanography, if indeed they have sufficiently strong stomachs.

Until about fifteen years ago, oceanography was only conducted vigorously in Scandinavia, Germany and in Japan. However, today I believe we have caught up with the rest of the world, in spite of a relative shortage of facilities. It is perhaps worth noting in passing that at one time the Japanese were operating fifty or more large oceanographic vessels. We have only two major oceanographic institutions and two or three small groups trying to get started. However, we can be well satisfied with what has been turned out during the last ten years. Almost single-handed, the Navy has been footing the bill for oceanography in this country and this is not entirely a healthy development because it has left marine biology falling rapidly behind physical oceanography and the two should proceed hand in hand. However, I hope that this can be corrected before too long.

I would like to emphasize that the research vessel *Atlantis* of the Woods Hole Oceanographic Institution has carried out many cruises in the last fifteen years. For example, she has just started out again on Cruise No. 157. The oceans are so large that no one expedition, however well organized, can add more than a small contribution to our store of knowledge. True, the instrumentation is improving rapidly, so that per day at sea we now take in much more information than was formerly the case, but it is the steady accumulation of data, rather than the results of any one cruise, that is gradually throwing light on the significant scientific problems of the ocean areas. The mid-Atlantic Ridge, a submerged mountain range stretching all the way from Iceland to Antarctia has been investigated three times during the last two years. However, in a two-month cruise one can only hope to examine a small sector of such a major geological feature. Nevertheless, a notable beginning has been made.

*Original version presented at the Second Annual New York Section Conference, ISA, January 28-29, 1949, Hotel Statler, New York; re-written for *Instruments*.

The primary tool in geophysical exploration of the Ridge is sound in one form or another. As secondary tools, there are various types of bottom sampling equipment. Sound has become a major tool in many sorts of oceanographic problems, for it travels well in water. During the past few years, we have learned how to receive relatively weak acoustical signals, even without having to stop the ship. Therefore, with sound, we can explore the ocean and the nature of the material underlying it with a minimum of delay to the ship. There is first of all the recording high-frequency echo-sounding instrument. This gives us a continuous record of the depth of the water and, when combined with the best navigational techniques, enables the bottom topography to be worked out in detail. Although, obviously, this is a long job, *Atlantis* has been averaging about 20,000 miles of continuous soundings per year. In the case of the North Atlantic, rather few data of comparable accuracy have been turned in by other ships during recent years. However, in January of this year, two Navy ships have been assigned to the Hydrographic Office for this sort of duty.

Sound generated by small explosive charges is a means of studying the acoustical characteristics of the interface between the water and the sediments, and, consequently, its physical characteristics. Measurements can also be made of the total thickness of the unconsolidated sediments. This is essentially the reflection technique of geophysical prospecting, as used in the oil industry, adapted to sea-going conditions. The routine on the ATLANTIS is to drop a three-pound charge of explosives over the stern every half-hour. A hydrophone is towed behind the ship and during the brief period when the reflected signals are expected back at the surface, the hydrophone cable is slacked away so that the sensitive element is nearly dead in the water. Thus, the background noise level at the hydrophone is favorable for the reception of weak signals which are recorded photographically in detail aboard the vessel. This is an extremely useful technique and the reception of echoes that have traveled through several thousand feet of bottom sediments, as well as through several miles of water, is quite practical.

The refraction technique, by which the velocity of sound in the bottom material can be deduced, requires two vessels or the use of the life boat. Here, the charges must be set off ten to thirty miles from the receiving vessel and thus, from the *Atlantis* and her whaleboat, refraction shooting is limited to especially favorable weather.

All of this has greatly increased the quantity of explosives that a research vessel must carry. For various reasons, we limit the *Atlantis* to about five tons, much to the disappointment of the geophysicists. So far, no one has been hurt.

It has long been recognized that the sediments on the bottom of the deep ocean constitute an undisturbed record of most of the earth's history. The problem was to get long cores of this material which could then be studied in detail in the laboratory to reveal changes in the conditions of deposition, such as major changes in depth or in climate. Until recently, the best coring tubes brought back only ten to twelve feet of sediment. Thanks to a simple Swedish development, we can now get cores thirty to sixty feet long, more or

The echo-sounding apparatus in the lower laboratory of Atlantis shows a portion of the continuous bottom profile obtained during each cruise.

less as a routine. Since the sediments probably accumulate at a rate of less than one-half inch in a thousand years, a fifty-foot mud core has quite a satisfactory time scale. To date, only about one hundred and fifty such long cores have been collected and their examination in the laboratory will not be completed for several years. However, it is clear, I think, that this type of investigation is capable of greatly advancing geology which, until now, has been very much a land-based science, in spite of the fact that most sedimentary rocks were formed in the sea.

Bottom photography in deep water is greatly adding to our knowledge of the role which the various large bottom-living animals play in reworking the mud. Many bottom photographs show a multitude of tracks and burrowings of various kinds of animals, and occasionally we can see the animals themselves. It will require a long and patient accumulation of bottom photographs before quantitative studies of the distribution of bottom-living forms can be undertaken.

Bottom dredges of various types capable of cutting off rock or of bringing up considerable quantities of bottom material, have, of course, long been used in oceanography to a limited extent. The trouble with dredges is that in deep water they are very time-consuming and the sample becomes more or less disturbed. The acoustical techniques and the long coring tubes are much more fruitful and economical of ship's time. It should be remembered that a modern research vessel costs about $300 a day to operate and this imposes a real responsibility on the scientific party.

As you will have noticed in the techniques described thus far, pressure is a minor factor. It influences the speed of sound and it is necessary to put the camera and its light source in a tight, strong case. For convenience and economy, this must be as small and as light as possible. Electrical leads through the case have to be carefully designed, but otherwise these aspects of oceanography are not much concerned with the effects of pressure or its measurement.

As soon as one tries making observations above the bottom, one is involved in the problem of knowing the depth of the instrument accurately. This is perhaps the second most important worry of an oceanographer. His first is: where am I; his second is: at what depth is my instrument? The navigational difficulties of an oceanographer have been greatly alleviated of recent years, over limited areas of the ocean, by the introduction of the radio locating system known as Loran. Especially between Cape Hatteras, Bermuda and the Grand Banks, the Loran coverage is excellent, so good in fact that we can know the strength and direction of the surface currents at all times when cruising in this area.

The most usual solution to the problem of knowing the depth of an instrument is perhaps unfamiliar and I will therefore take a moment to describe it. The deep-sea reversing thermometer, as developed in Germany, is a very beautiful and precise instrument. It records the temperature to better than one one-hundredth of a degree Centigrade. The thermometer, which has a constriction in the capillary so that the mercury column breaks off when it is reversed, is protected from the pressure of the water by a glass case. The reversing of the thermometer is accomplished by releasing a small weight at the surface to slide down the supporting wire and trip a simple mechanism which allows the thermometer to turn end for end. No further change in the reading occurs after the thermometer has been reversed. A series of such thermometers suspended on a wire will provide a number of points for the construction of a temperature-depth curve, provided one knows the depth of each of the thermometers. The way this is done is to send the thermometers down in pairs; one protected from the pressure of the water, the other exposed to it. The elasticity of the glass in the unprotected instrument causes it to read somewhat higher than the pressure-protected instrument with which it is paired. The design can be made such that one one-hundredth of a degree dif-

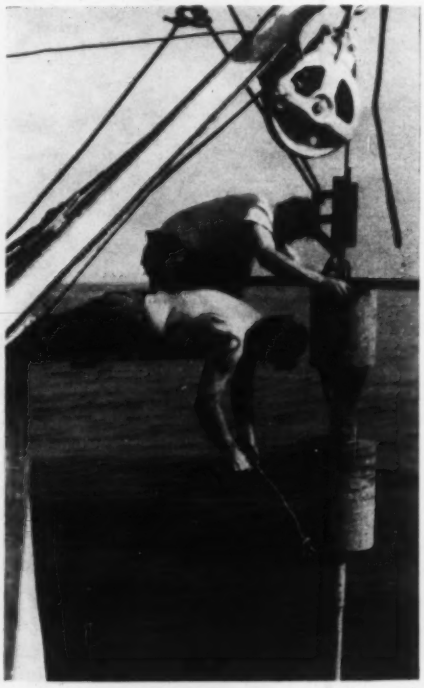
ference is about equal to one meter of depth, that is, at 3000 meters the unprotected thermometer will read about 30 degrees higher than its mate. Thus, if there were no other complications, we would have in a pair of these thermometers a pressure gage capable of giving the depth to the nearest meter. In actual practice, the error can be as great as plus or minus three meters in the range between 1000 and 4000 meters. However, the great advantage of this system is that we have in the thermometers a corrosion-proof pressure gage and it is easy to know the time at which the readings are obtained.

At shallower levels of recent years, Bourdon elements have been used extensively in oceanography in several different types of sampling equipment, but the corrosion problem is not easily licked.

I would like to point out that in studying the currents we have no instrument exactly analogous to a barometer, although the circulation problems in the sea and in the atmosphere are much the same. In both cases, under steady conditions, the cross-current pressure distribution must balance the deflecting force of the earth's rotation. The fact that in one case you are dealing with a gas and in the other case with water makes surprisingly little difference. Meteorologists study the winds in relation to the pressure distribution. Oceanographers would like to be able to observe the pressure distribution in the sea directly, but since our cables seldom lead straight down to the instrument, we have to use pressure to indicate the depth. Then on the basis of the density distribution, calculated from observations of temperature and salinity, we can compute the pressure field. In oceanography, the analogous instrument to a barometer would show the slight topography of the sea surface. For example, theory tells us that at Bermuda, because of the Gulf Stream's flow, sea level must be about forty inches higher than on our East coast. If the current stopped, sea level would fall about twenty inches at Bermuda and rise about twenty inches at New York. Thus, changes in mean sea level at the two points would show changes in the strength of the current and tide gage data are used for this purpose. However, there are too few islands to make it possible to construct any sort of weather map of the ocean currents on the basis of the varying topography of the sea surface.

The general pattern of the ocean currents has been derived from ship reports of the difference between dead reckoning and observed positions. A very large number of such reports are available and permit the construction of average surface-current charts. These show broad, slow eddy-type movements. It has been found recently that the currents at any one time are quite different from the average, just as the average winds are different from those on the daily weather maps of the meteorologists. However, obviously, the changes in the currents must be somewhat slower than the changes in the winds. In oceanography, a week is perhaps equivalent to a day in meteorology.

About ten years ago, in oceanography, we had arrived at the point where it had been demonstrated that the simple theory of the effect of the earth's rotation on currents was adequate to explain average conditions, that the distribution of temperature and salinity in the sea agreed with the average current charts derived from the navigational reports of ships and that the seasonal and, to some extent, the longer-period variations of the currents were reflected in the pressure distribution. It was evident that in general the currents were caused by the winds, that is to say, the distribution of pressure was the result rather than the cause of the currents. There are minor exceptions to this statement about which oceanographers like to argue endlessly.



Dr. M. W. Ewing adjusts a shackle on the 1,000-lb. lead weight ballast of a piston coring tube.

The new navigational techniques, combined with much improved ways of measuring temperature continuously against depth near the surface, have recently enabled us to study the details of the currents in limited areas. What we find is that the currents are much narrower and swifter than had been supposed. At any one time, for example, the Gulf Stream is flowing past New York at a speed of five or six knots, but the swift part of the Stream is only about twenty miles wide and meanders widely. Great loops develop which break off as eddies and persist for several weeks. These eddies move in a clockwise direction north of the Gulf Stream and anti-clockwise south of the Stream. The synoptic picture is very differe from the average picture, jus as in t case of meteorology.

Since the ship is relatively ast co pared to the currents and sinc throu Loran we are now able to kno the su face current at all times, it possib to alter the ship's course in lligent so as to trace in some detail e ma features of the stronger curr nts. Th is proving to be a very interes ng stu indeed. Especially we are beginning understand why it is that there a such big biological variations fr year to year. As long as the curre were thought to be slow and gradu it was difficult to see, for exa ple, h the production of fish could be great influenced by them. Now that we kn that powerful eddies are associate with the currents and that the curre themselves are not fixed in position, is evident that from time to time t very young fish can be swept away fr their usual nursery areas. We have the fluctuating current system som thing corresponding to weather and t marine population is affected by th "weather" in somewhat the same ma ner as the land population is affected.

Although I am writing for reade trained in the physical sciences, and i deed my own training is also on th side, I would like to end this artic with some general remarks abou marine biology. This is a backwar subject—again for the reason that mos biologists prefer to work in the lab oratory, but also because the fe marine biologists were stymied until th physical oceanographers could explai to them the characteristics of the en vironment. It has also been difficult t make quantitative studies of the large marine animals. The microscopic stu can easily be caught, but except in shal low water, where effective means o catching bottom and surface fish hav been developed by fishermen, we kno almost nothing about the quantit of fish that exist in the open ocea They are not seen at the surface and i has generally been assumed that the were also scarce at depth. The smal nets used by naturalists only brough up a few, sluggish, grotesque creature out of the depths of the oceans.

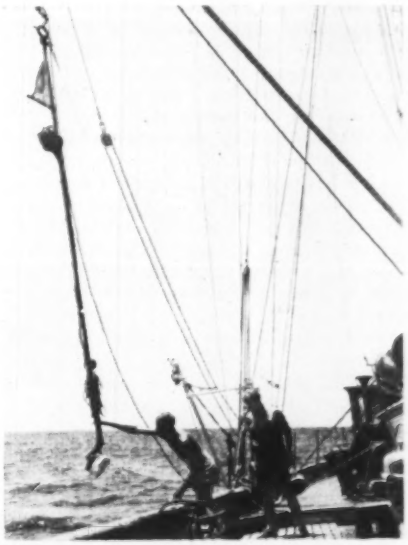
Meanwhile, by studying the smaller forms found near the surface, especial ly the microscopic plant forms, it had been shown that the seas were by n means deficient of life as compared t the land. Acre per acre, the annual plant crop in the sea is somewhat more than on land. It is a more three-dimensional crop and it consists mainly of micro scopic forms, but it knows no drought and there is a fairly good supply of the critical nutrient chemicals such as phosphates which have been washing off the land since the beginning of time. The most recent figures show that up t 90 percent of the photosynthetic activity on earth occurs in the sea and per haps only 10 percent on land. Thus, one can say that although man is beginning to be pinched for food, he may only be attacking 10 percent of the basic production. This is something that the ag-

culturists and the conservation people seem to forget. At least, the recent popular books that have called attention to the dangers of over-population in the face of distruction of our land resources, never mention the sea.

I must admit that as long as the problem of harvesting the sea was thought of as being a three-dimensional one, it did not seem at all practical. Fisheries experts have thought that only in shallow water areas, where specially favorable conditions existed, were fish to be found in quantity. Fishermen have no doubt found most of the productive areas near land, but they have never tried at all to fish in deep water. For a modern trawler, yields of five or six tons per man per day are entirely possible. This is cheap production of protein compared to farming. Yields of one ton per man per day are common in the case of the more desirable food fish. The problem has not been production, but preservation of the catch. It seems to me that modern refrigeration has largely solved this problem and we can soon expect to see fishing vessels working at much greater distance from port. Even if profitable fishing remains limited to the shallow areas near land, refrigeration alone can bring about a doubling or a tripling of the present world catch without any danger to the stocks of the commercial species. In fact, it is inefficient to allow so many fish to reach maturity, as is the case today. The older fish grow much more slowly than the younger ones. Remember that in fishing, man is not touching the plant production in the sea and that most fish lay a great many eggs. Only for a few local species which happen to have few eggs is there any likelihood that fishing will influence the production. Compared to the fluctuations produced by natural causes, man exerts only a small influence on the size of most fish populations. Thus, as far as the known commercial species are concerned, the prospects are bright for a greatly increased production without any worries of over-fishing. Fishing remains in the bow-and-arrow stage and, when the need arises, can be made much more efficient. For example, at present fishing is highly selection. A few species, which keep well under the present system of lightly icing fish in the holds of the fishing vessels, are sought out with great skill by the fishermen and they carefully avoid the so-called trash fish, for which there is at present no market. As a result, the trash fish are increasing in quantity. If the trash fish could be removed, and perhaps converted to fish meal and fish oil, there would be more food for the so-called edible species. Again, I will remind you that in fishing man is not touching the plant production in the sea. The basic food supply remains the same and therefore the total production of fish has probably not been altered.

Finally, let us take a brief look at the 90 percent of the ocean area where nobody ever fishes at all. This is somewhat less productive in plant forms than the inshore waters where chemical nutrients are being washed into the sea by the rivers; but even so, the average plant production per acre remains higher than on land. What is the end product of this open-ocean plant production and where is it located?

A significant clue to this problem has recently turned up with the introduction of the recording echo sounder. We find that everywhere in the open ocean echoes are returned not only from the bottom, but also from mid-depths. These echoes are at times nearly as strong as those from the bottom. In the Atlantic,



The underwater camera surfaces after a lowering. In this case a tripping weight was suspended below the camera to obtain a photograph at a higher distance from the bottom. The camera housing is near the top of the pole. Flashbulbs are housed in the plastic cover on the bottom of the pole. Above Mr. D. M. Owen's right hand is the tripping mechanism and battery housing for the flashbulbs. Dr. M. W. Ewing at right.

they come from a depth of about two hundred and fifty fathoms by day. In the Pacific, they come from slightly shallower level, but in both cases the layer rises to within about seventy-five fathoms of the surface at night. The phenomenon is known as the scattering layer. The layer responds quickly to changes in the illumination. Thus, by watching the echo sounder, one can tell when clouds obscure the sun or moon. The layer becomes somewhat diffuse during the middle of the day and during the middle of the night when the illumination is fairly constant. Each morning and each evening, during the period of vertical migration, the acoustical scatterers draw together again.

The behavior of this layer corresponds to what is known about the habits and distribution of certain small shrimps named Euphausids. These are caught in much greater quantities within the scattering layer than above or below. Yet it is difficult for me to believe that Euphausids alone can account for the strength of the echoes, no matter how many of them there may be. Furthermore, the character of the echoes corresponds exactly to the echoes produced by half a dozen species of commercial fish which school in shallow waters.

Clearly, the Euphausids approach the surface each evening to feed on the small plants which, of course, only flourish in the zone through which sunlight can penetrate in quantity. By day, they retreat to what for them must be a great distance, to the darkness, roughly one thousand feet below. Does it not seem possible that active, firm-bodied fish are feeding on the Euphausids which are known to exist in tremendous quantity? It is difficult for me to believe that the end of the food chain stops at these small shrimp, although most marine biologists hesitate to accept the idea that any large stock of unknown fish is involved.

I am less cautious, for I know well how inefficient all deep-sea nets are. These are not more than six feet in diameter at the mouth and are ordinarily towed at only about two knots. I doubt that any self-respecting fish would ever be caught in such a primitive device, even if it were towed at the right depth, which it usually is not.

In any case, some definite conclusions can be drawn from these scattering layer observations:

(1) The shrimp, at least, are not distributed at random so that if means could be devised of catching them, it would not be a three-dimensional problem.

(2) The shrimp exist in much greater volume than had been supposed, for they too are able to some extent to avoid the small, slow nets of the naturalists.

(3) The center of abundance of the animal population in the open ocean remains well below the optimum layer of plant production by day and even at night it is at fifty or more fathoms below the surface.

(4) Through the shrimp, the plant material of the vast open ocean is being efficiently turned into protein. Now, the whalebone whales are known to live on these shrimps and a whale's mouth is not a very efficient straining mechanism. Presumably, man could devise something much more effective, if need be, to harvest the shrimp. He is already doing a good job on the whales.

Finally, I hope that before long somebody will go to work on the tantilizing question of whether the sound coming from the scattering layer is from the shrimp or from larger animals feeding on the shrimp. If the latter is correct, this would provide a very dramatic and easy solution to the world's increasing protein shortage, but even if I am optimistic, my basic argument is sound: the sea produces a huge annual crop of plants; these in turn are converted into protein by the grazing marine animals; if man has to, he can undoubtedly devise means of exploiting this huge source of food; we have not even scratched the surface as yet, for fishing today, with few exceptions, is limited to a few small coastal areas near port. The sea is a great biological frontier and it is to be regretted that the basic knowledge necessary for its understanding has been forthcoming so slowly. In time, man will undoubtedly have to turn to the sea for a major part of his food requirements and before he does this and begins to destroy this last major natural resource, scientists should be prepared to explain the dangers and limitations.

Standardized Radiation Instruments *for* Army Training Use

By CHARLES De VORE, Signal Corps Publication Agency, Fort Monmouth, N. J.

MILITARY requirements of compactness, serviceability under field rather than laboratory conditions, use and maintenance by soldiers rather than physicists, operation under atmospheric extremes, coupled with an awareness of limited production facilities, were conflicting design considerations that determined equipment specifications recently completed by the Signal Corps in cooperation with the Radiological Defense Division of Armed Forces Special Weapons Project for two radiation survey instruments intended for use by the Army Field Forces, with a possibility of adoption by the Navy and the Air Force for training use.

One of these equipments, known as the Radiac Training set AN/PDR–T1–(), is an ionization chamber to measure gamma radiation intensities from 0.5 to 50,000 milliroentgens (mr) per hour. The second, designated as Radiac Training Set AN/PDR–T2–(), is a Geiger-Mueller type counter for detecting gamma and beta radiations with gamma intensities varying from background to 50 mr per hour.

Physical requirements for the two instruments are essentially the same. Outstanding among these requirements are those for moisture resistance. To withstand the rigors of military field operations, cases (and probe tube in the case of the G-M counter) must be water-proofed and capable of withstanding immersion test under water for thirty minutes. Instruments must be tropicalized, in accordance with standard Joint Army-Navy specifications. The instruments must be capable of giving satisfactory continuous operation with less than 15 percent change in calibration over a temperature range of from minus 10 deg. F. to plus 125 deg. F. with an external relative humidity range of five to 100 percent. Cases and components must be able to withstand storage temperature ranging from minus 80 deg. F. to plus 165 deg. F. All metal parts, of course, must be of corrosion-resistant material. The instruments must be sufficiently rugged to withstand conventional shock and vibration tests. As a requirement peculiar to the AN/PDR–T2–(), the commercially available Geiger tube probe (metal container) with beta shield in place is required to be of such strength that when freely supported at both ends, it will not deform more than 1/16 in., under a static center load of 80 lbs. support and loading surfaces having an area of one square inch.

While the components are to be readily accessible for maintenance and service testing, the case fastenings are to be designed so that it will be impossible to open the case without the use of simple, standard tools, such as screwdrivers or pliers. Indicating instruments are to be illuminated for night operation, the operator lighting them by means of a spring-loaded switch convenient to the carrying handle. In common with equipment procured for the National Military Establishment, the instruments must be made of commercially-available component parts, which conform to JAN specifications.

The electrical requirements of the two instruments differ somewhat with respect to detection because of the nature of the instruments involved. The AN/PDR–T2–(), for example, will incorporate a standard commercially-available thin-wall Geiger-Mueller tube, having a total effective thin-wall tube thickness of not over 35 mg./cm.^{2} nor less than 20 mg./cm.^{2}. The tube will have a Geiger threshold of 825 volts with a plateau having a slope of not more than 5 percent per 100 volts over a range of not less than 75 volts. The center of the plateau must not exceed 900 volts. The tube must have a minimum count life of 10^8 pulses.

As a part of this instrument, a movable shield must exclude a minimum of 95 percent of all beta radiation of 3.5 Mev. energy from the tube. The probe will be equipped with detents to hold the shield in either the open or closed position. With the shield open, the probe should have a minimum of 60 percent external area opening along the beta-sensitive length of the tube. The G-M tube will be mounted on a probe with at least a 36-in. flexible cable, covered with a smooth, non-porus cover, preferably not rubber. The probe must be so constructed that G-M tubes can be easily replaced by removing one or more sections of the probe and the tube is to be mounted with a plug-in base.

The AN/PDR–T1–(), on the other hand, must be wavelength independent within 15 percent and air equivalent from 80 kev up to and including 1.5 Mev quantum energy gamma radiation.

The ionization chamber survey meter will have five ranges: 0-5, 0-50, 0-500, 0-5,000, and 0-50,000 mr/hr, with corresponding scale colors of white, yellow, orange, pink, and magenta, as an aid in identification. The G-M survey meter will have three ranges: 0-0.5, 0-5, and 0-50 mr/hr with corresponding scale colors of green, white, and yellow. It will be noted that similar ranges on the two instruments will have the same colors, a detail of value in training.

Time constants for the two instruments will be roughly the same. For the ionization chamber instrument, it shall be such that 95 percent of the final reading is reached after a period of not more than eight seconds on the most sensitive range, that of 5 mr/hr, with five seconds on the 50 mr/hr range, and two seconds on the higher ranges. The least sensitive range, in both instruments, is to be the first range in order of switch rotation from the "[illegible]" position. Calibration of the instrument must not vary more than 15 percent when the instruments are airborne to altitudes of 36,000 feet. Both instruments are to be able to withstand radiation intensities of at least five times their maximum readings without showing saturation effects. The reason for this requirement is quite obvious when one considers the danger involved in using instruments which, on reaching their maximum reading, suddenly saturated and dropped off to zero ("0") thereby giving a false sense of security to the monitors.

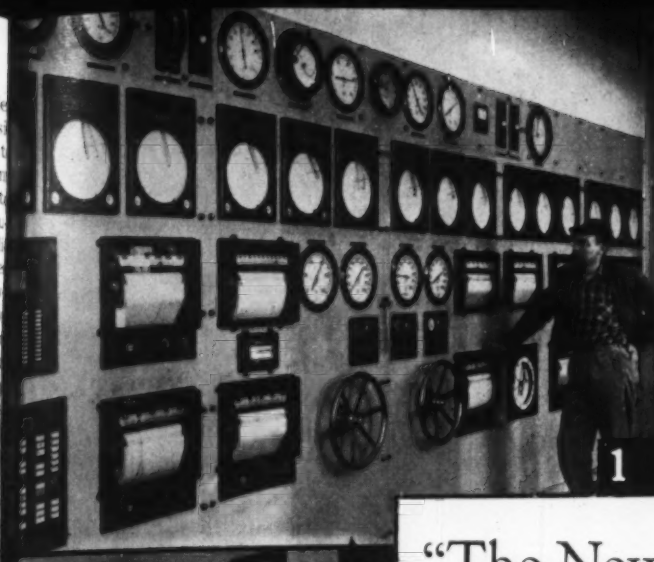
As a characteristic peculiar to the ionization chamber survey meter, the instrument circuit is to be so designed as to incorporate a zero set position to check the meter zero of the instrument or the meter reading when no current is being passed through the input resistor from the ionization chamber. This feature will enable checking the zero position when the instrument is located in gamma fields greater than full-scale deflection on the least sensitive range.

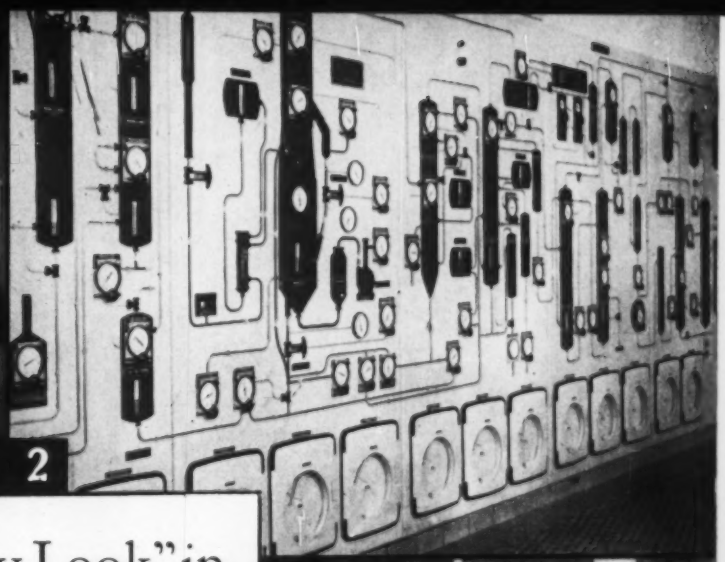
Since the G-M survey meter is only an indicating device, it will include a provision for a waterproof phone jack with a circuit arranged for use of either crystal or magnetic head phones.

Stability requirements are identical for the two instruments. Insofar as microphonics are concerned, the instrument shall withstand a 1 in. drop to a hard surface with the indicating instrument not changing more than one-quarter the full-scale reading and returning immediately to the zero position. In addition, the indicating instruments must not move more than one-eighth full-scale in response to jars, such as light raps of the operator's knuckles against the side of the cases. With respect to circuit noises, zero fluctuations must be less than 2 percent of full-scale reading after a warm-up period of one minute. After a 30-second warm-up period, the instruments are to indicate greater than 90 percent of final reading and attain a zero drift of less than 15 percent of full-scale per hour within one minute of the initial turn-on of the instruments. Calibration adjustments are to be incorporated.

For training purposes, as well as for reference in the field, technical manuals will be packed with the equipments. These manuals, in common with similar publications prepared for other military equipment, will include full information on description, theory of operation, installation, operating instructions, and maintenance—including operator's preventive, and corrective or repairs. As an additional training aid, one out of each fifty instruments to be procured will be in the form of an easily-portable classroom demonstration or "breadboard" model, labeled and arranged to show the operating features of the units.

The author wishes to thank Mr. C. K. Shultes, Nucleonics Section, Evans Signal Laboratory, for his active cooperation in the preparation of this article.





"The New Look" in Control Boards?

(SEE COVER PHOTO)

1. Old control board for Rock Island Refining Co., Indianapolis, before enlargement of refinery.

2. New board, conceived by David Boyd of Universal Oil Products Co., engineered and constructed by Panellit, Inc., not only controls all new facilities but controls old units in proper coordination. Bottom-row instruments are temperature transmitters. It took only 15 hours to "tie-in" this new board.

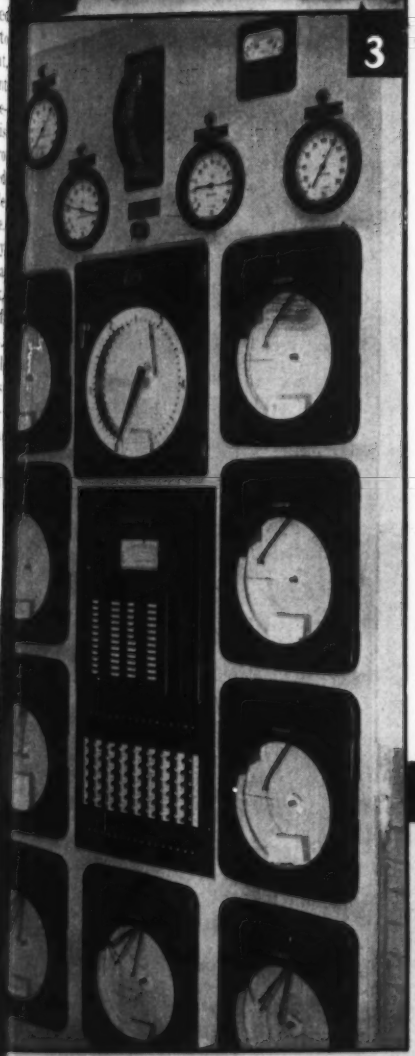
3. New recorder panel for entire refinery.

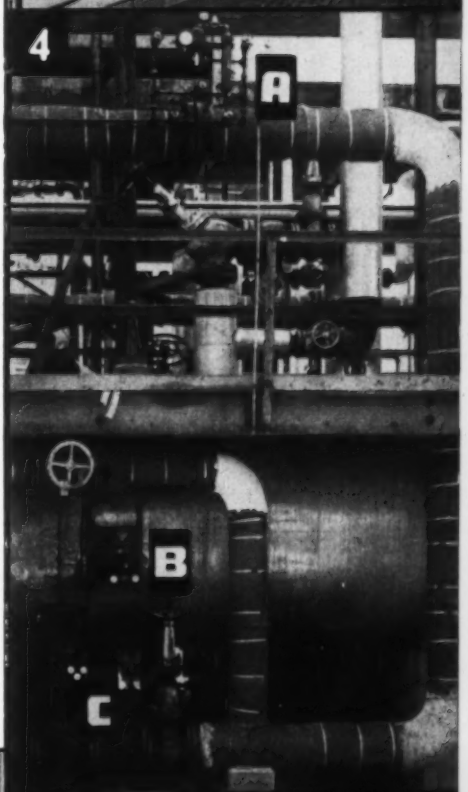
4. One of the 52 remotely-controlled processing stages. (A) Orifice-plate with mercuryless flow transmitter. (B) Self-contained automatic controller, commanded at all times from the remote control board. (C) Valve and positioner.*

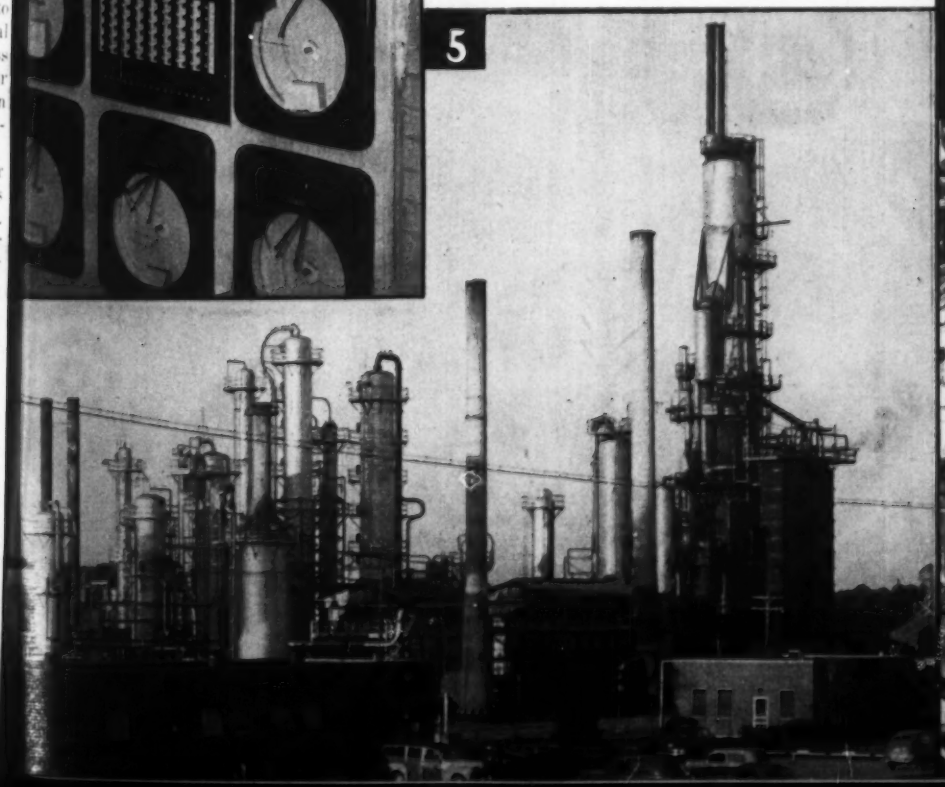
5. General view of the refinery. New U.O.P. fluid cat craker at right.

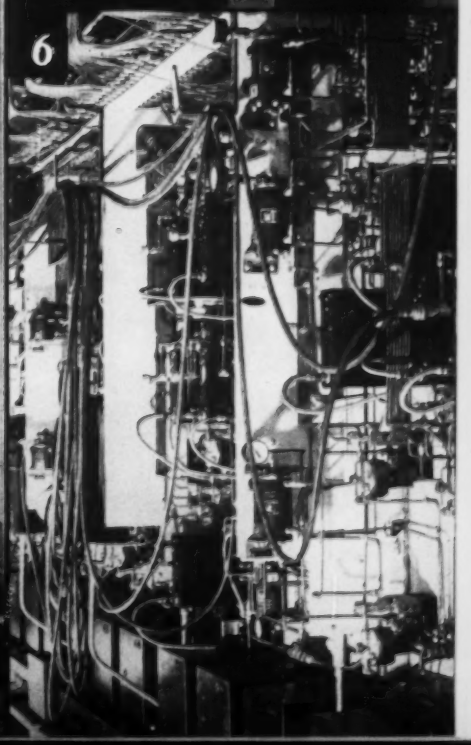
6. Part of the back of the board. Rubber tubes from controllers to recorders are purposely used to accomplish the "plug-in" function. —MFB

*Retouching—blacking out confusing background behind valve and positioner—was necessary.



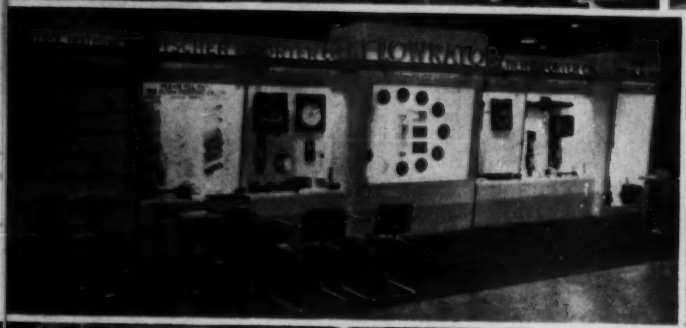


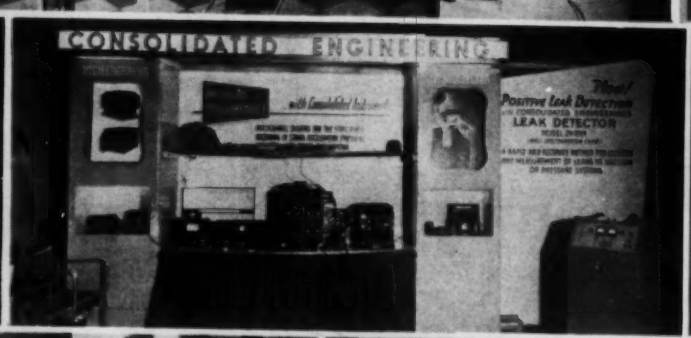


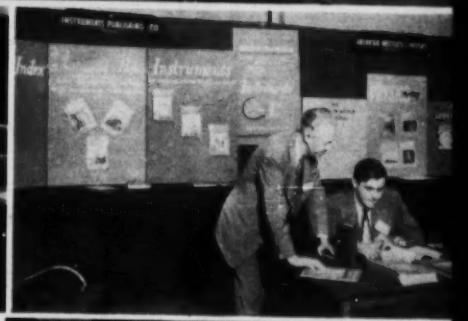


INSTRUMENT-COMPANY EXHIBITS AT ST. LOUIS SEPTEMBER 12-16

On these five pages *Instruments* takes pleasure in reproducing ALL the photographs of commercial exhibits (seventy in number) received up to closing-date for this October issue.







HELICOID
THE PRESSURE GAGE OF UNSURPASSED ACCURACY
WILSON
HOLTZER CABOT
INSTRUMENT
DAVIS
DIVISION
PANELGRAPH BY PANELLIT, INC.
for WOOD RIVER OIL & REFINING CO. Inc.
MINIATURE

WIRE TERMINATION

PALMER

ALFAX
RECORDING PAPER

Telechron
MOTORS
TIMERS

THE
ESTERLINE-ANGUS
Graphic RECORDING
INSTRUMENTS

J. BISHOP & CO
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Gilbarco

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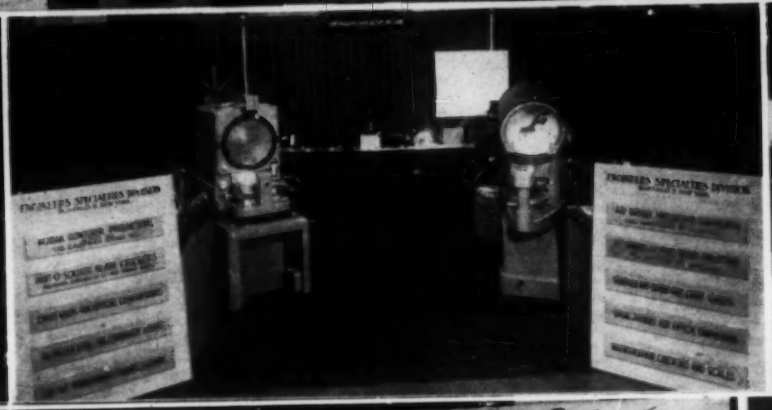
% PROPORTIONEERS, INC. %
CONTINUOUS AUTOMATIC BLENDER

Applied Research Laboratories

DURABILITY

KIELEY & MUELLER



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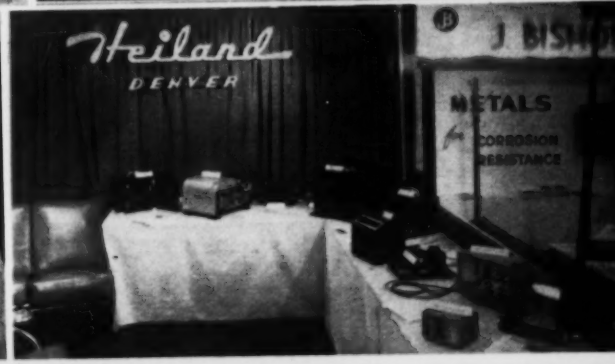
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Electromik
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Some Application Factors Affecting *the* Regulation *of* pH *in* Industry

By ALLEN L. CHAPLIN, Consulting Engineer

V. PROCESS LAGS

Lags in a pH control process are serious limitations to successful operation. The rate of reaction of most processes is high, and any delays brought about by lagging regulators aggravates control. Theoretically, the process reaction rate should be the only limiting factor, and regulators should be capable of responding through full range in less time than required by the process reaction. Furthermore, there are certain theoretical advantages in bringing process liquor and reagent together in molecular films rather than in residence volume, but neither of these ideal conditions is practicable and we are limited by more conventional aspects of the problem.

Fig. 58 is a schematic illustration of the usual lags encountered in a pH process. All, except demand-side capacity lag, react unfavorably if not removed entirely or kept small.

Measuring lag of the electrodes is an important factor about which little has been published. The glass electrode has a tendency to absorb hydroxyl ions on its surface, which

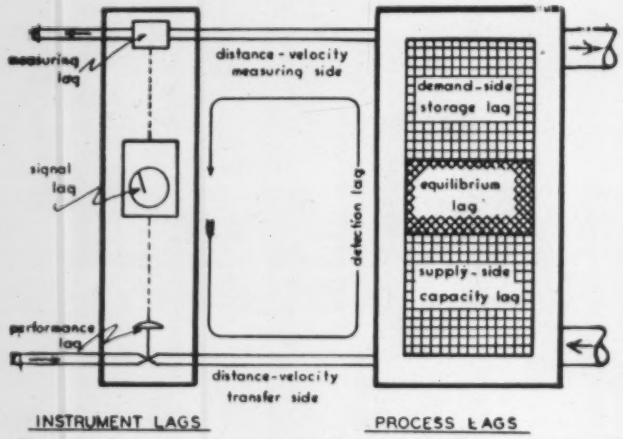

Fig. 58. Schematic illustration of lags which affect automatic pH control.

seriously limits its rate of response to pH changes in strongly alkaline solutions. Sometimes the electrode lags for several seconds—or even minutes—in reaching equilibrium in alkaline solutions, and its behavior may be treated in control analysis identically with response lags of a thermocouple encased in a heavy well. Regarding the delay of glass electrodes in reaching equilibrium E-pH values under varying conditions of applications, a specialist* writes:

> It is not possible to give a simple answer to your questions regarding electrode time delays. In addition to the fact that electrodes using various glass compositions behave very differently in response to pH changes in the solutions being measured, various effects occur on the aging of the electrodes during use which cause them to change materially with time. The critical factors are not well understood but they are clearly tied up with the surface chemistry of glass in contact with aqueous solutions. When a freshly prepared electrode is put in an aqueous solution there is an initial induction period during which some kind of equilibrium is set up between ion diffusion into and out of the glass through a silica gel layer formed at the surface of the glass. The equilibrium is radically affected by temperature, glass composition and solution composition. The rate at which the equilibrium can be changed by changing the pH of the solution varies a great deal with the age of the electrode and with the structure of the silica gel layer formed on its surface. "Young" electrodes come to equilibrium with strongly buffered solutions almost as fast as electrical measuring circuits can be made to follow the changes, at least in the middle pH ranges. Older electrodes may require anywhere from several seconds to several minutes before stable potentials are established.

Fig. 59 is a graphical illustration of the characteristic response of some glass electrodes as affected by the conditions described above. Bearing in mind that a change in pH of 1.0 corresponds to a change of approximately 60 millivolts at room temperature, the response rates indicated might be considered very good for most industrial applications since the worst condition, corresponding to 13.7 pH, represents a discrepancy of only approximately 0.1 pH. Most industrial continuous pH measurements are made within the limits of 3.5 and 10.0 pH, with the highest probable average near neutrality, 7.0 pH. Under ordinary conditions, and for all practical purposes, the response of glass electrodes in this range may be regarded as representative of process conditions within the limitations of accuracy of industrial equipment where there is a free flow of solution over the electrodes.

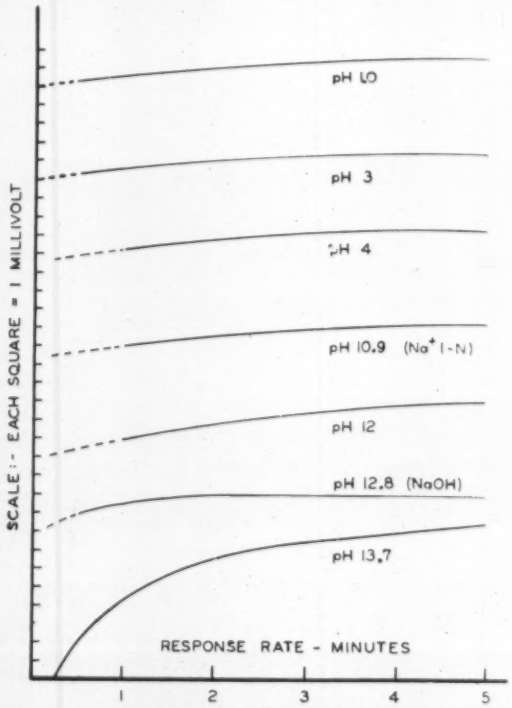

Fig. 59. Trend of delays in response of glass electrode to pH changes. *(Courtesy National Technical Laboratories)*

Viscosity of the solution, as in rubber latex, etc., impedes a free transfer of process liquors past the electrodes and may introduce a slight discrepancy in measured pH. Precipitates or coatings over the electrode surface may insulate it from instantaneous contact with the solution and delay response to pH changes. Other conditions affect the response of glass electrodes, and the reader is referred to more comprehensive texts** for a full discussion of these effects.

* * *

The signal and valve transfer lags have been minimized greatly by use of modern electronic measuring techniques; and pneumatic controllers have been favored over electrical power-unit types for many critical applications because of faster valve action. In general, the instrument lags have been fairly well standardized and are not the source of major difficulties in a control installation. The process installation itself and the manner in which equipment is applied present the most serious lag problems.

One of the most serious process lags is supply-side capacity lag. This lag introduces a storage and residence effect on transfer of reagent to the reaction vessel. A typical example, given in Fig. 60, is representative of lime neutralization of acid waste water having the acidity characteristic illustrated in Fig. 10.

Acid waste flows at constant rate into a long basin having

*National Technical Laboratories, South Pasadena, Calif., Private correspondence.

**Malcolm Dole, "The Glass Electrode," John Wiley and Sons, Inc., New York, 1941.

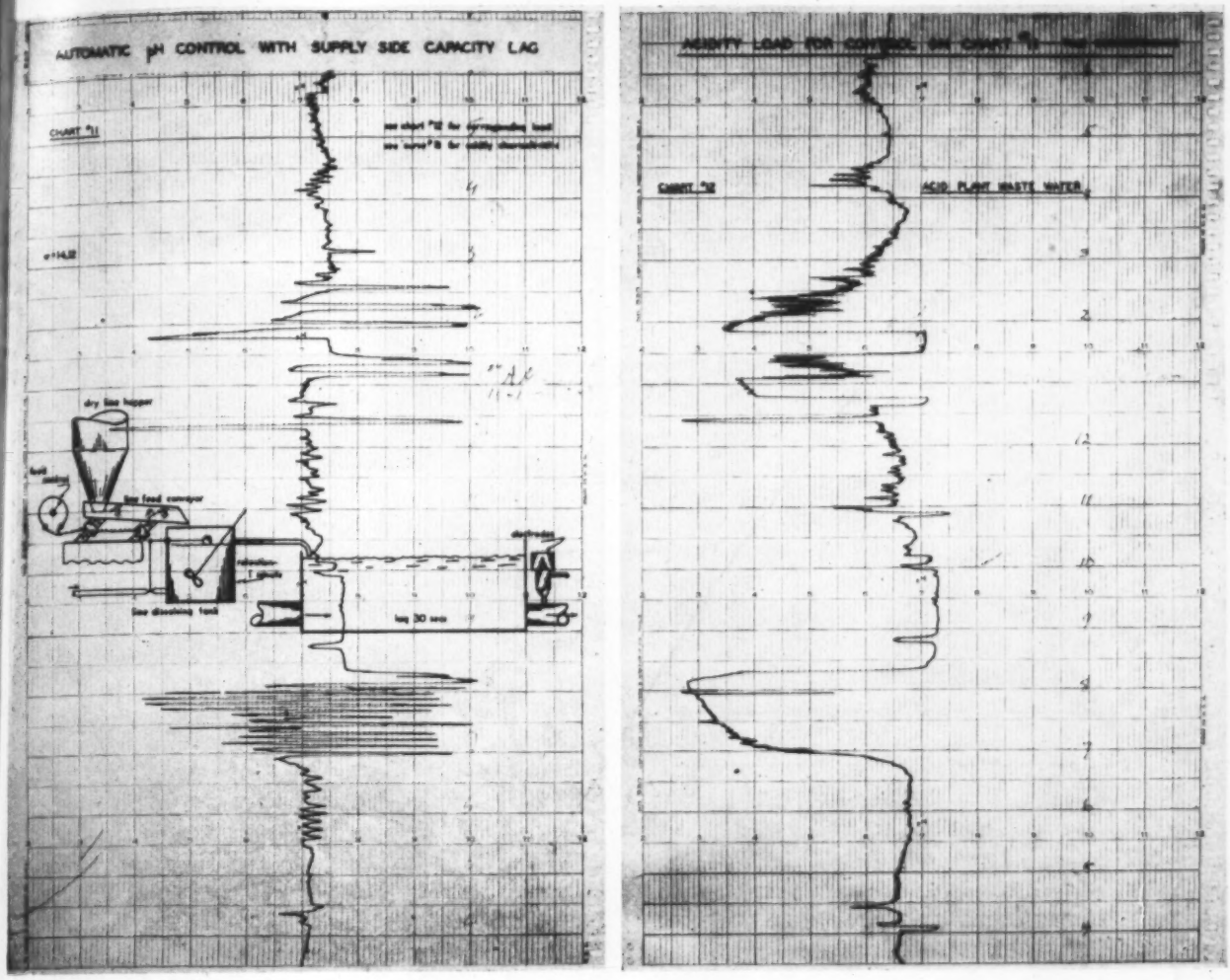

Fig. 60. Illustrating effect of supply-side capacity lag on pH control process. Right-hand chart is record of pH load on regulator. Left-hand chart is record of corresponding control obtained under best possible conditions of regulator adjustment.

a 30-second transportation lag, thus requiring half a minute for the electrodes to "see" changes made at the input. Reagent water is fed at constant rate from a lime-dissolving tank into which dry lime is fed at a rate controlled by the pH regulator. A load change at the electrodes causes a change in feed rate of lime to the dissolving tank which, by virtue of its residence action, converts linear changes of dry lime feed to exponential changes of concentration in its discharge stream. This stream is discharged at constant flow-rate into the control basin and reaches the electrodes 30 seconds later.

This type of lag makes it difficult, if not impossible, to regulate pH with any degree of precision.

The right-hand chart of Fig. 60 is indicative of the pH load on the regulator while the left-hand curve represents the best possible corresponding regulation which could be obtained. The residence basin itself is doing the major portion of regulation on this job and, except for periods of minor sustained load changes, the regulator serves no useful purpose and the results are not to be regarded as satisfactory.

It is sometimes customary on waste disposal jobs to discharge neutralized acids into a large sump pond where, it is contended, everything equalizes and levels out. Wild control records are not regarded as serious since the pond smooths out irregularities. If such is the case and if the process cannot be designed as required for pH regulation, the pH equipment serves no useful purpose and represents only an expense and maintenance item. Equally satisfactory results can be obtained by fixed settings of reagent feed determined by periodic analysis of grab samples taken from the residence basin. In such cases the residence basin does the regulation; the pH controller is helpless and cannot contribute beyond the combined effects of the residence basin and sump pond.

Supply side capacity lag is a serious limitation to pH control and must be eliminated.

* * *

Distance-velocity lag in process vessels may become manifest as a transfer delay with resultant effect upon reaction period of the process. This type of disturbance is represented in Fig. 61, illustrative of pH control in the coagulation basin of a water treating plant. Normal detection lag, inclusive of all process and instrument lags, is 6.0 minutes at minimum throughput rate of 3 Mgd (3 million gallons per day).

The right-hand chart illustrates the best control obtainable at minimum flow-rate. Decreasing velocity-distance transfer by increased throughput rate has the stabilizing effect illustrated by charts to the left; the exreme left representing 10 Mgd throughput. In view of the extreme detection lag of this process, any or all of the charts could be regarded as "remarkable."

Except for equilibrium lag, which is a time function, and (in some cases) demand side capacity lag, which is a storage function, all lags in a pH control process must be kept as low as possible for good results.

* * *

VI. SOME TYPICAL AND APPROVED pH CONTROL INSTALLATIONS.

(A)

An outstanding distinction of the *concentration* variable over others is its rate of reaction. It is not uncommon practice in chemical processing to split flows of process streams and overtreat one stream for subsequent use as the reagent for final blending with the untreated stream to achieve closer regulation and more uniform blending. This technique is applicable only where the treating reactions are reversible.

Continued on page 950

Quick-Selection Chart *for* "SR-4" Strain-gage-type Pick ups

By G. L. ROGERS, Chief Test Engineer, McDonnell Aircraft Corp., St. Louis, Mo.

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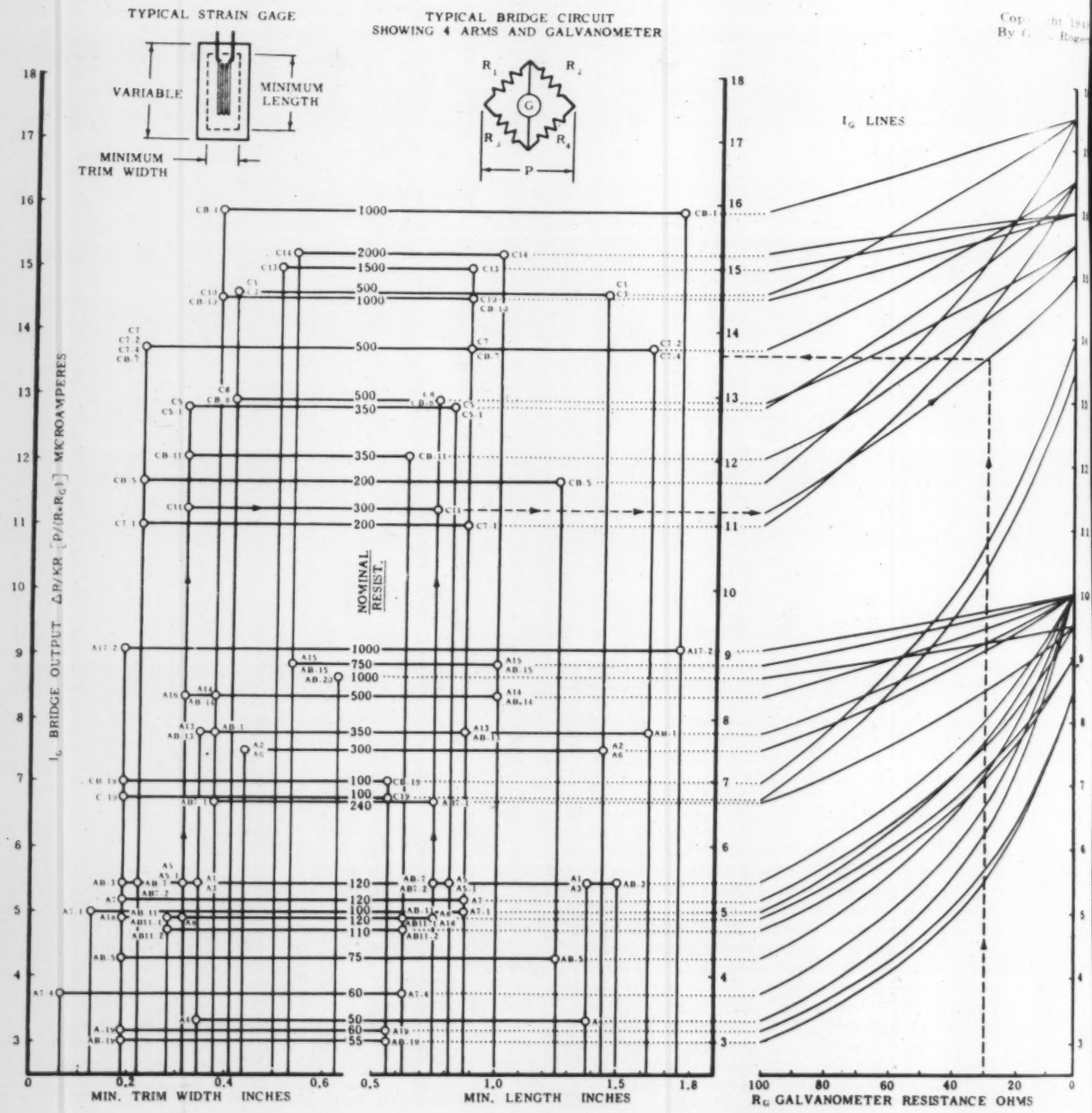

Chart Derivation

I_G = Bridge Output = $\Delta R/KR\ [P/(R + R_G)]$, where $\Delta R/R = GF(\Delta L/L)$.

GF = Gage factor, and $\Delta L/L$ = strain inch/inch also equals stress/modulus of elasticity, or $10^3/10^7 = 0.0001$ for aluminum at 1,000 psi.

P = Potential applied to the bridge taken equal to 1 volt for each 20 ohms of gage resistance = R/20.
(Note: one strain gage per active arm.)

R_G = Resistance of galvanometer = 100 ohms. (Note: varied between 0 to 100 ohms to obtain family of I_G lines.)

K = 1, Four arms of the bridge active.

Therefore:

$I_G = GF/10{,}000\ [R/20\ (R + R_G)]$ microamperes

$E_G = I_G R_G = GF/10{,}000\ [R/20\ (R/R_G + 1)]$ microvolts

EXAMPLE

A constant-strength steel beam is to be designed to fit into a limited space in a wind-tunnel model control system. The working section of the beam not to be more than 0.35″ wide and 0.80″ long. Bending stress not to exceed 30,000 psi. Electric circuit composed of two SR-4 strain gages (R_1 and R_2) forming one-half of a Wheatstone bridge and including a galvanometer with 30 ohms internal resistance. It is desired to use a strain gage of relatively low resistance.

From the chart, the logical choice would be a C11 gage having minimum width = 0.31″, minimum length = 0.75″ and resistance = 300 ohms.

To find approximate bridge output, I_G, extend horizontal line C11—C11, until it intersects the proper I_G line, and then follow the I_G line until it intersects the vertical line drawn from R_G = 30. Extend back to the I_G ordinate and read 13.64 microamperes. From the table below the output is multiplied by the following condition factors:

(A) Two active arms, Factor = 1/2

(B) 30,000 psi, Factor = 30,000/1,000 = 30

(C) Steel beam, Factor = $10 \times 10^6/30 \times 10^6 = 1/3$

Therefore the output $I_G = 13.64 \times \frac{1}{2} \times 30 \times \frac{1}{3} = 68.2$ microamp. or approximately 0.07 milliamp. The corresponding $E_G = 68.2 \times 30 = 2046$ microvolts, or approximately 2 millivolts.

Multiplying Factors for Other Conditions

Conditions	Multiply the ordinate scale by the factor
One active arm	1/4
Two active arms	1/2
Stress greater than 1,000 psi	Actual Stress/1000
Material other than aluminum	$10^7/E$ (Material)
To find E_G	R_G

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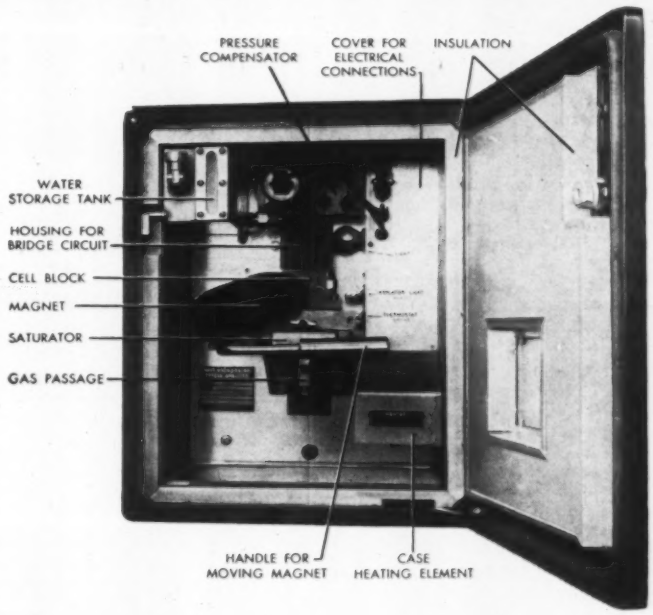
HAYS ACRATRON *Electronic Type* RECORDER



The **HAYS OXYGEN ANALYZER** is unique inasmuch as it operates on an entirely new principle, based on the paramagnetic property of oxygen. It has been tested and proved in service to do the job of measuring oxygen with sustained accuracy and dependability in many fields, notably, the oil refining field—on catalyst regenerators; in the chemical field—for measuring both O_2 and CO_2; in the metal working industry—for soaking pits, annealing furnaces and heat treating furnaces; the safety field—wherever hazardous explosive gases may exist; and in the boiler room field—for determination of combustion efficiency.

Note these 12 Special Advantages

1. Makes use of the paramagnetic property of oxygen as the basis of measurement.
2. Highly sensitive to changes in oxygen content with rapid response.
3. No chemicals, no liquid or gaseous fuels, no combustion required for its operation.
4. Its super-accuracy is permanently maintained.
5. Not affected by wide variations in rate of flow of gas sample.
6. Rugged construction—no delicate or moving parts. Corrosion-resisting material used where required.
7. Easily installed—small gas line, one small electric conduit—no special fittings.
8. Recorder mounted separate from analyzer at any convenient remote point.
9. As many as four records of O_2 and CO_2 can be provided on one chart, each record continuous and distinct.
10. The presence of hydro-carbon gases and vapors does not affect the operation of the analyzer.
11. Analyzer universally applicable, with sustained accuracy, to all flue gas analysis resulting from the combustion of any fuel with air.
12. Analysis is automatically compensated for barometric pressure, ambient temperature and water vapor dilution.

HAYS ACRATRON Electronic Type Recorder

The Recorder which is a self-balancing AC potentiometer is sold separately when desired, to design and research laboratories which have developed special measuring and transmitting devices that call for accurate recording and indicating. The Hays ACRATRON Recorder can provide as many as four records on a single chart, each record continuous and distinct. Special Bulletin 49-909.

SEND FOR THE COMPLETE STORY—The complete story on the Hays Magno-Therm Oxygen Analyzer and ACRATRON Electronic Type Recorder is told in Bulletin 48-829. Send for it today.

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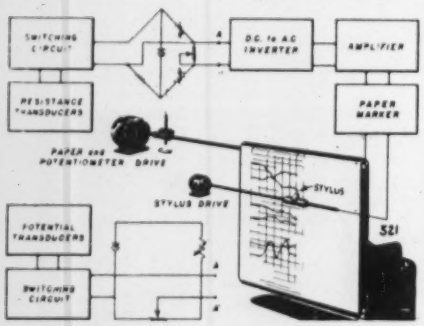
High-speed Multi-point Recorder

New "Speedsweep Recorder" is a high-speed multi-point recorder of the null-balance type, utilizing method disclosed in detail in "The Keinath Recorder," *Instruments*, April 1946, pages



200-210, but incorporating refinements not described in this original disclosure. An endless belt of electrosensitive chart paper is moved at a constant speed under a marking stylus. This belt-chart is divided into one or more vertical columns of charts. One variable is recorded on each chart in one column, during each revolution of belt. Primary variables are recorded vertically; time axis is horizontal. Speeds of ten points per second or faster are obtained by maintaining continuous motion of all mechanical elements. Accuracy is up to 0.5 percent. Rapid interpretation by inexperienced operators is possible since rectangular coordinates permit rapid interpretation, and only one variable is shown on each chart. Charts can be cut apart for convenient filing. Chart movement is mechanically coordinated with a continuously-rotating precision voltage-dividing resistor connected in a Wheatstone or potential bridge circuit. Each time VDR arm passes through null with reference to an external measuring element (thermocouple, strain-gage pick-up, etc.) stylus produces a mark on paper. Stylus is driven across endless paper belt to establish a time base and to produce a rectilinear record: a line of closely-spaced dots. Multi-point operation is accomplished by selecting in sequence the primary elements to be recorded, using a selector switch with mechanical drive from VDR arm.—*Sperry Products, Inc., Danbury, Conn.*

Mention No. 1001 when filling out card.

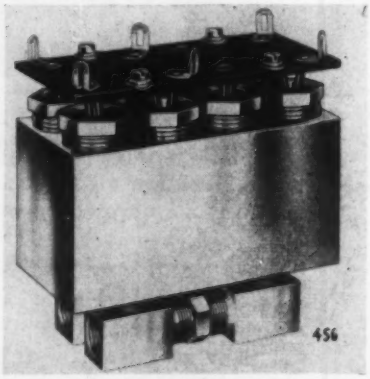
High-temperature Resistance-thermometer Elements

New platinum resistance thermometers entirely embedded in pure alumina and fired at a high temperature are said to extend measurement range to pyrometric temperatures. Units of conventional design are useful only to 500 C. or thereabouts. At higher temperatures glass and mica become conductive and both materials lose their mechanical strength. Alumina does not contaminate platinum as quartz does. It is still an excellent insulator at 1400 C. Its softening point is near 2000 C. New units are 4 inches over-all length, 0.259 in. diam. and provided with platinum lead stubs. Standard resistances are 25.5 and 60 ohms. Units have no unsupported windings at any point; are therefore sturdy.—*Paul G. Weiller, 95 Broad St., New York 4, N. Y.*

Mention No. 1002 when filling out card.

Gas-analysis Units

New "Type M" thermal conductivity units for gas analysis have same close adherence to specifications as maker's earlier products, but offer greater usefulness in gas analysis instrumenta-



tion by reason of greater bridge output and larger variety of models available. "Type M/K" for continuous-service systems gives a signal comparable to that originating with thermocouples, can be incorporated into pyrometer circuits with only slight changes and recalibration; bridge is mono-metallic "Type M/K-SS" has same electrical and physical characteristics but is made of stainless steel for more corrosive gases. "Type M/K-8" (illustrated) is an eight-filament bridge with doubled output and features for recording and control circuits. In gas-air tests, this unit has an output of 1.70 millivolts for 1 percent CO_2 in air and 11.8 millivolts for 1 percent H_2 in air. Companion model "M/T-8" has an output of about five times that of "M/K-8." Both units are mounted in a 6-inch steel cabinet complete with gas-flow fittings and electrical terminal strips. "Type M/T" is a supersensitive four-spiral filament unit which has been selected by designers of portable and semi-portable instruments: easy to use with many standard commercial galvanometers and standard power supplies. Also announced is new "RCC Control Panel and Bridge Current Indicator" for laboratory user: comprises all control elements needed for simple d-c. circuit usually employed and leaves only power supply and galvanometer for procurement from already-existing equipment. — *Gow-Mac Instrument Co., 22 Lawrence Street, Newark 5, N. J.*

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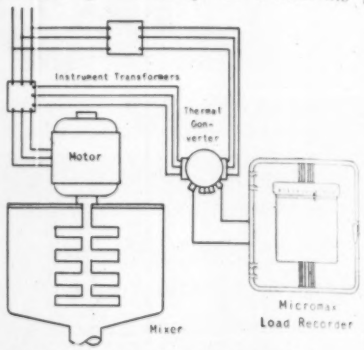
Load Recorders and Controllers for Mixing Machines

New adaptation of maker's self-balancing recorders and automatic controllers is announced for recording or controlling viscosity of materials in



mixing or other types of agitating machinery which can be measured indirectly by measuring power input to electric motor which drives mixer. A thermal converter is connected in power leads to drive motor, and converter output is wired to a potentiometer-type "Micromax Load Recorder." Instrument continuously records motor input in kilowatts or on some arbitrary scale. When so desired, "Micromax" is equipped to operate alarms, etc., for some processes it can be supplied to provide automatic control. Where several machines are operating in one shop, data from all of them can be recorded on a single "Micromax" multiple-point instrument. Thermal converter smooths out usual erratic variations in motor load and permits accurate analysis of trends. Because potentiometer method is used for measurement, distance between thermal converter and "Micromax" has no effect on accuracy of measurements.—*Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia 44, Pa.*

Mention No. 1004 when filling out card.

Multi-circuit Pyrometers

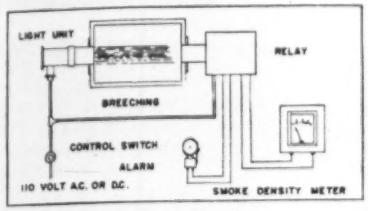
New "Alnor Type 1200 Portable Multi-Circuit Pyrometer" is a direct-reading instrument particularly useful in making tests involving temperature rise of various portions of an electric-

ally-operated device, or repetitive tests on a group of devices. Accuracy is 0.5 percent. Two switch capacities are available: 8-circuit and 17-circuit. Instruments can be calibrated for any standard thermocouple alloys. Double-range instruments have automatic compensators adjusted for high range only. Actual cold-end setting can be checked at any time by turning selector switch to "off" position and comparing instrument reading with thermometer reading. — *Illinois Testing Laboratories, Inc.* 420 *N. LaSalle St., Chicago* 10, *Ill.*

Mention No. 1005 when filling out card.

Smoke Indicator

New model of "McNeil Smoke Indicator" is a heavy-duty unit with oversize light beam and easy-to-read density

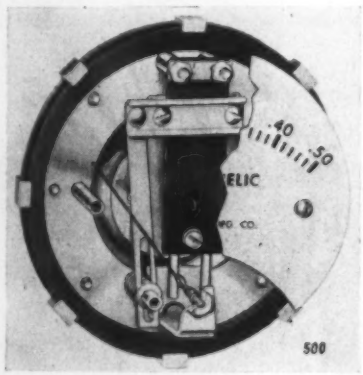


meter. It is more compact, and easier to install and service than previous model. Recorder can be added at any time. It can be used on a 15-foot span of breeching. — *Trimount Instrument Co.*, 37 *W. Van Buren St., Chicago* 5, *Ill.*

Mention No. 1006 when filling out card.

Sensitive Air-pressure Gage

New "Magnehelic Gauge" is said to be extremely sensitive, unusually efficient in checking furnace draft, measuring air velocity, etc. A spring-loaded flexible diaphragm has its motion transformed to rotary pointer motion by means of a helical magnetic linkage.

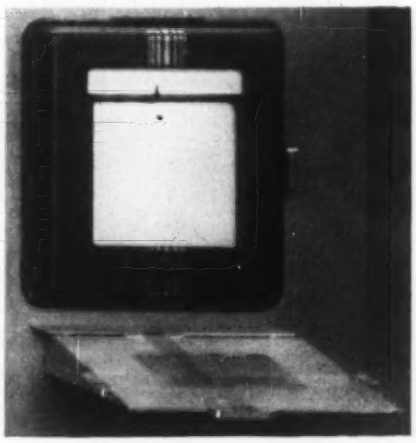


This action is entirely frictionless, as magnet force causes helical assembly to assume a position in which magnetic force can travel through minimum air gap. Magnet motions as small as 0.00025 in. cause pointer motions. Plus, minus and differential readings are available. Pressures below atmospheric are connected below diaphragm; gage pressures are connected above diaphragm. Ranges are 0-0.5 in. of water to 0-12 in. of water. Maker states that new gage is not a delicate instrument and that no special precautions are necessary in using it. It is suitable for portable temporary use as well as for permanent installation on flowmeters, control equipment, automatic valves, gas-air ratios, etc. All types of connections are possible—rubber tubing, 0.125-in. pipe thread or 0.25-in. copper tubing, and gage may be used in any position including upside-down.—*F. W. Dwyer Mfg. Co.*, 317 *S. Western Ave.., Chicago, Ill.*

Mention No. 1007 when filling out card.

Coordinatograph or *X-Y* Recorder

New "Two-Function Speedomax Recorder," though conventional in appearance, is unconventional in performance: not only does pen travel across chart in response to its measuring circuit, but chart drive now has a similar circuit, so that paper can move up and

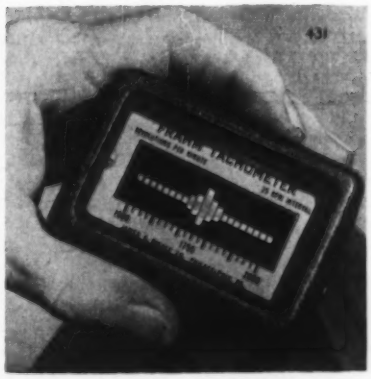


down, instead of being merely time-driven. Result is a freehand motion, similar to penmanship. To plot two algebraic functions, it is only necessary to convert them to d.c. for the two circuits. Photograph shows new instrument and also an *X-Y* board—which, of course, is superfluous in most applications. These applications include plotting of stress vs. strain curves, temperature vs. temperature-difference relationships, hysteresis loops, etc. Instrument is many times faster than customary point-by-point method of manual plotting.—*Leeds & Northrup Co.*, 4901 *Stenton Ave., Philadelphia* 44, *Penna.*

Mention No. 1008 when filling out card.

Miniature Tachometer

New miniature "Frahm" resonant-reed tachometer requires no contact with rotating element; imposes no load on machine under test; cannot be injured by over-speeding; requires no maintenance; measures vpm. as well as

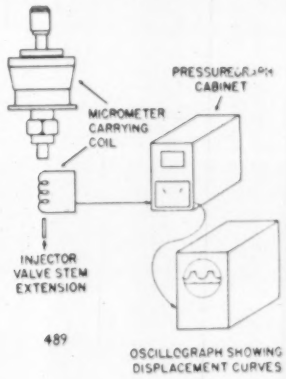


rpm.; is available in various ranges between 1000 and 13,000 rpm. Cases are available to accommodate one or three instruments, or 60- or 90-degree brackets for permanent mounting.—*James G. Biddle Co.*, 1316 *Arch St., Philadelphia* 7, *Penna.*

Mention No. 1009 when filling out card.

Displacement-measuring Pick-up

New "Model 3610" displacement-measuring attachment for use with "Electro Pressuregraph" equipment permits making micrometric measurements of reciprocating motion, valve opening, valve bounce, or any motion



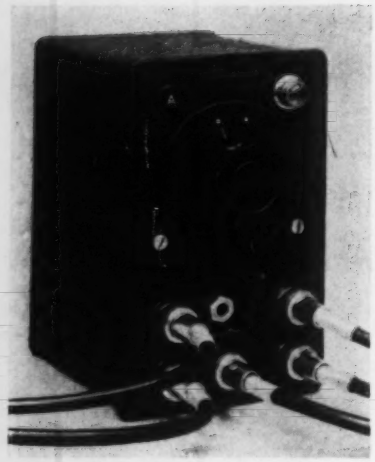
OSCILLOGRAPH SHOWING DISPLACEMENT CURVES

including vibration; will also show a displacement-vs.-time curve on CRO screen (important when measuring acceleration). Operation: a h-f.-energized coil is mounted in a conventional micrometer head. Voltage drop across coil is made to vary by movement of valve stem in coil field, changing inductance and, therefore, reactance of coil—producing a voltage variation across coil. Displacement curve is viewed on screen as a modulated h-f. envelope: minimum height of curve (valley) corresponds to zero displacement or movement. Next, micrometer sleeve is backed off from moving body until maximum envelope height is reduced to previously-noted minimum. Total displacement is then read directly on micrometer as difference between these two setting. (Micrometer sleeve is calibrated in 0.0001 inch.)—*Electro Products Laboratories, Inc.*, 549 *W. Randolph St., Chicago* 6, *Ill.*

Mention No. 1010 when filling out card.

Analog Computor Components

New "K3 Analog Components" are self-contained all-electronic operational units, each engineered to perform its special function as part of a computing system. Case dimensions approx. 4 x 5 x 7 in., weight approx. 5 lbs. Five-pin input and output connectors in back carry 110 volts at 60 cycles, a ground lead, and plus and minus 300 volts d.c. for power. On front, one or more input jacks and two output jacks proved for computing signal interconnections via standard coaxial cable. On each component an indicating dial serves for setting characteristics, and a lamp signals any limiting of output signals. Ratio of input to output impedance is between 100,000 and infinity. All signal voltage ranges are from minus to plus 50 instantaneous volts. Illustrated is new "K3-A Adding Component" or "Adder" which admits from one to four input signals and features an adjustable additive steady level up to 20 per-

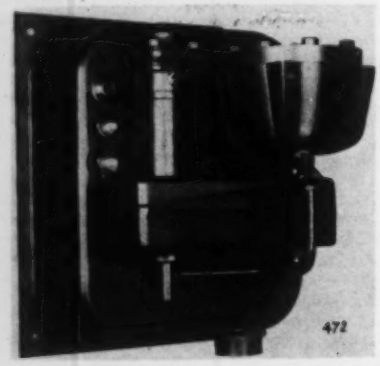


cent of range. Either output, or both, may be employed, giving plus or minus the direct sum of all inputs being used. No attenuation is involved. Through tandem interconnection of "Adders," any number of signals may be combined in sums and differences.—*George A. Philbrick Researches, Inc., 230 Congress Street, Boston, Mass.*

Mention No. 1011 when filling out card.

Flow Meter with Magnetic Coupling

New "Hays - Penn Magna - Clutch" flow meter features a magnetic clutch to transmit float movement. "More

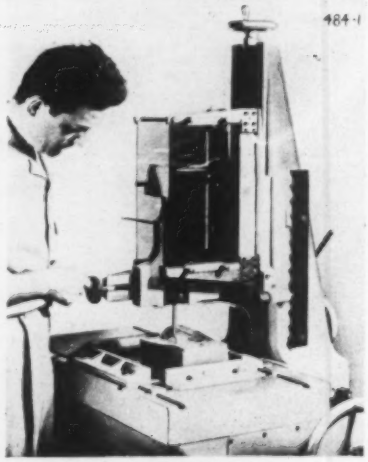


power with less friction" is claimed for new meter owing to its large float (3.75 in. in diameter) and long float travel (1.5 in.). Five adjustable range tubes give wide rangeability—anywhere from 17 in. to 750 in. water differential. Working pressures are given as 1500 psi. and 2500 psi. (convertible in the field). Six types or combinations of recording, indicating and integrating meters are offered.—*The Hays Corporation, Michigan City, Indiana.*

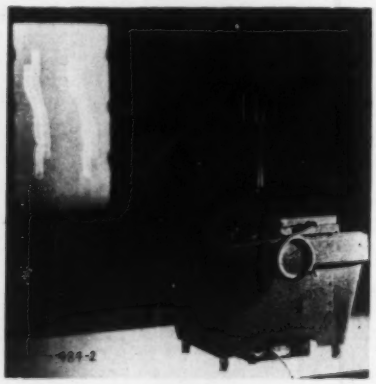
Mention No. 1012 when filling out card.

Contour-tracing and Projecting Die Checker

New "Pant-O-Scriber Die Checker" provides a fast, accurate and inexpensive visual method of gaging the contour profiles, flash and striking surfaces for forging dies and punches. It incorporates many features of maker's "Pant-O-Jector" and "Pant-O-Scriber" turbine blade checkers (see *Instruments*, May 1947, pages 410-412). An adjustable and interchangeable follower, 0.125 in. radius, is attached to one end of an arm, opposite end of which carries a motor-driven free-floating rotating spindle with a "fly-tool" type of scribing cutter head. This cutter rotates in circles of same radius as tracer follower. As tracer moves across die in X plane, scribing cutter duplicates movements and in so doing "cuts" or "scribes" colored film from "Pant-O-Scriber" glass. Arm is also mounted on a cross-beam in Y plane. Result is corresponding movements of scribbing cutters in both X and Y planes. "Pant-O-



Scribed" glass plate is then removed from machine and placed on measuring stage of a "Vu-graph Delineascope." A precision "one-to-one" ratio master chart is properly positioned on delineascope, and "Pant-O-Scribed" glass is

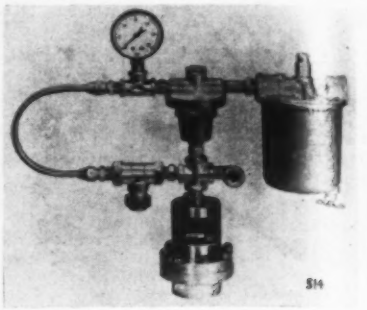


placed in register with master chart. Both master chart and "Pant-O-Scribed" glass are in proper focal plane and both are simultaneously projected onto an opaque white projection screen. Die contour and master, in contrasting colors, are in true relationship to each other as projected on screen. Fig. 2 shows viewing screen as seen by operator. (This projection can be clearly seen in a fully illuminated room.) Green and red scribed "Pant-O-Scriber" glass shows as grey in this photo, with cavity, flash and gutter profiles clearly discernible.—*Engineers Specialties Div., Univ. Engraving and Colorplate Co., Inc., 980 Ellicott St., Buffalo 8, N. Y.*

Mention No. 1013 when filling out card.

Pneumatic Transmitter

New "F-C Series 5000" pneumatic transmitter is said to meet all of the requirements for measurement of pressure, vacuum, specific gravity and level

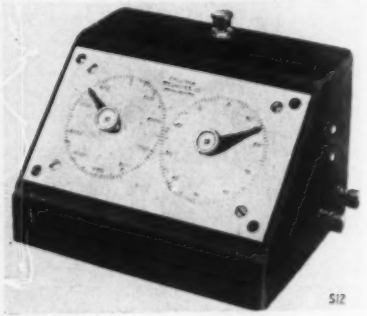


(or by means of two transmitters to measure differential pressure or flow). It employs force-balance method with a fixed nozzle system: no levers, pivots or fulcrums, as entire measurement system depends on travel of diaphragm towards or away from nozzle. Accordingly, it is said, extremely high sensitivity, accuracy and absolute repeatability are inherent in this system. Another claimed advantage is isolation of transmitting air pressure from measured variable by diaphragm. This eliminates any possible aeration of material (troublesome or prohibitive in numberous applications). Also, since there are no open connections, it is impossible for measured material to back into transmitting system in event of air failure.—*Instruments, Inc., Tulsa, Okla.*

Mention No. 1014 when filling out card.

Count Controller

New "Cyclo-Trol Register" is designed to accurately control mechanical cycles. By means of two calibrated dials, it can be instantly set to any number from 0 to 10,000. When a cycle

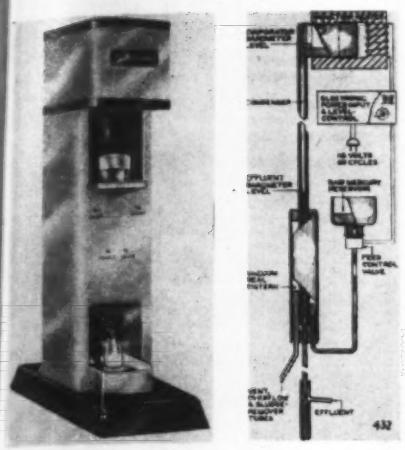


is completed, it can be returned to original setting by pressing a button, so that specified cycles may be repeated any number of times without resetting dials.—*Cyclotron Specialties Co., Moraga, Calif.*

Mention No. 1015 when filling out card.

Mercury Still

New "No. 31-162" induction-heated mercury still is a fast, economical producer of high-purity distilled mercury. Electronic controls are truly automatic; operator needs only to supply raw mercury which begins to flow within 4 to 6 minutes after "START" button is pushed. Power consumption of 500 watts

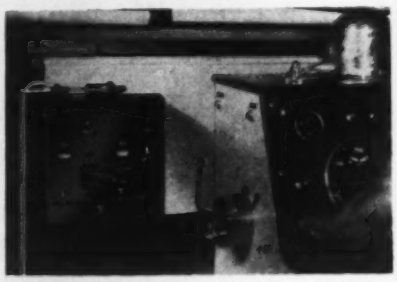


produces 5 to 7 pounds of distilled mercury per hour. Fully automatic safety devices protect unit, which operates directly from 115 volt, 50-60 cycle a.c. It occupies floor space 18 by 24 inches and stands approximately 6 feet high.—*Eberbach & Son Co., 200 E. Liberty St., Ann Arbor, Mich.*

Mention No. 1016 when filling out card.

Gas Alarm for Motorboats

New Combustible Gas Alarm for motorboats operates continuously, is designed to sample simultaneously from two below-deck locations, actuates a warning when flammable content of air sample exceeds approximately 25 percent of lowest concentrations which can be exploded. Air samples are drawn through two tubes from testing points to instrument by an integrally-mounted centrifugal type pump. Separate pilot lights indicate a safe condition in both test areas, and two alarm lights separately signal presence of a dangerous vapor concentration. Zero-setting check is made possible by a quarter turn of two 3-way valves attached to each sample tube. Each of the two analyzer systems is equipped with a separate flow

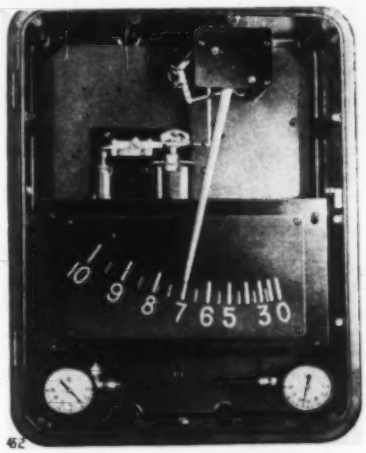


indicator to show that proper sample rate is being maintained. Instrument is powered by boat's 6-volt d-c. lighting circuit.—*Mine Safety Appliances Co., Braddock, Thomas and Meade Streets, Pittsburgh 8, Pa.*

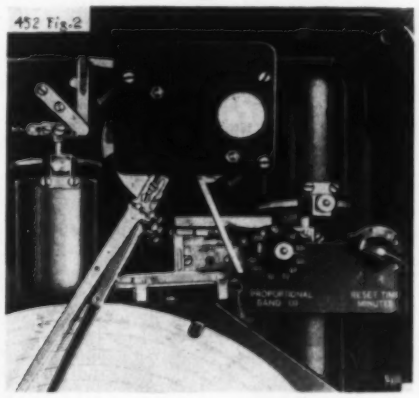
Mention No. 1017 when filling out card.

Pneumatic Transmitters, Controllers and Receiver-controllers

New "Series A-88 Pneumatic Instruments" for transmitting and controlling flow, pressure, liquid level, and specific gravity, have been designed with coöperation of operating instrument engineers; embody features requested by process industries. Maintenance and service problems have beeen simplified by minimizing number of pivot points and moving parts. Interchangeability has been achieved by unitizing sub-assemblies and standardizing parts, making new instruments readily convertible to changing conditions and applications. A positioning device simplifies linkage alignment in the field; a spring-closing bellows-sealed reset valve is calibrated according to time; a nozzle assembly permits adjustment of nozzle without



breaking tubing connections; relay includes a damping device for smooth operation and is equipped with a self-cleaning primary orifice and by-pass arrangement which permits changing to

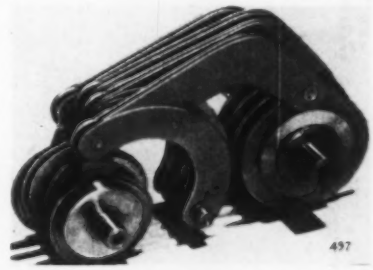


manual control by turning one screw. New instruments can be reversed by shifting one end of one link without disturbing other adjustments. Fig. 1 shows a transmitter, Fig. 2 shows detail of a proportional-reset controller-receiver.—*American Meter Co., 60 East 42nd St., New York 17, N. Y.*

Mention No. 1018 when filling out card.

Speed-control Component

New "Zero-Max" speed control device, infinitely variable from zero to maximum, is a torque-conversion structure. A crank motion on input shaft creates linear motion which is absorbed on output shaft by a series of one-way overriding clutches. A leverage mechanism is placed between the two shaft structures for infinitely varying length of stroke from zero to maximum; hence infinite speed variation from zero to 4-to-1 ratio. Advantages claimed for "Zero-Max" are that it is compact, can be mounted in any position, provides level flow of power, has instant response to change of speed which can be made either while oper-

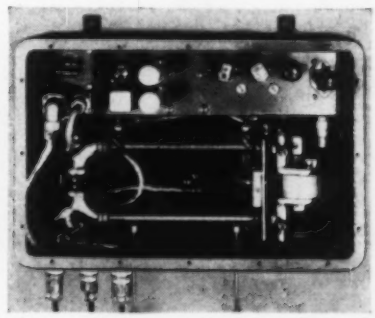


ating or stopped, excellent low-speed as well as high-speed performance, high starting torque, silent operation and low original cost. Smallest unit, which will handle loads up to 10 inch pounds output torque, measures 4 x 2.75 x 1.25 in.; is available complete with case or as internal mechanism (illustrated) only.—*Revco Inc., Dep't I, 405 Thorpe Bldg., Minneapolis, Minn.*

Mention No. 1019 when filling out card.

Gas & Liquid Analyzer

New "LIRA" (Luft-Type Infrared Analyzer) is a gas and liquid analyzer for use in measuring atmospheric contaminations and for process control. According to manufacturer, it has almost unlimited possibilities for detect-

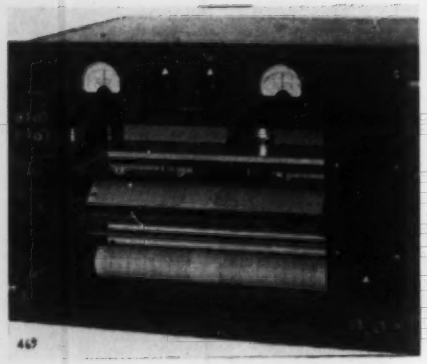


ing minute as well as heavy concentrations of various atmospheric contaminates and may be made selective so as to measure one specific product in the presence of several. This feature makes it suitable for process control. Operating principle is that most gases, vapors, and liquids will absorb infrared energy in spectral regions specific for each product. An example of its uses in industrial process control would be to measure propane and butane in natural gas before and after that gas has passed through a natural gasoline plant to measure recovery efficiency of plant. It may be used for measuring the purity of various chemicals and simple or complex mixtures.—*Mine Safety Appliances Co., Braddock, Thomas and Meade Streets, Pittsburgh 8, Pa.*

Mention No. 1020 when filling out card.

Twin Recorder

New "Model RZ Graphic Twin Recorder" has been extensively redesigned; it has an extended frequency range, improved mechanical construction, and a complete metallic enclosure

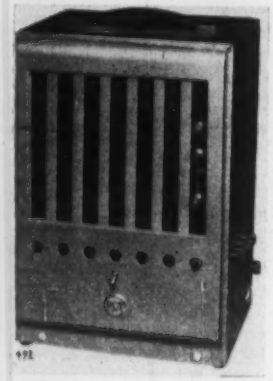


of instrument. It is a dual frequency response recorder which can record simultaneously two different signals on a 10-inch wide double-track chart. Recordings of frequency response characteristics, simultaneous recording of noise and vibration, or beam-pattern recording and directional properties of transducers can be conveniently recorded. New model of this recorder is in rack form with all operating controls on front panel and is powered by two synchronous motors, one to drive writing pens and one for chart advancement. Gears of chart drive are interchangeable and can be synchronized with any available oscillator, or wave and sound analyzer.—*Sound Apparatus Company, Stirling, N. J.*

Mention No. 1021 when filling out card.

Time-interval Counter

New restyled "Model WF-99C" of maker's electronic time-interval counter (third commercial model) features an

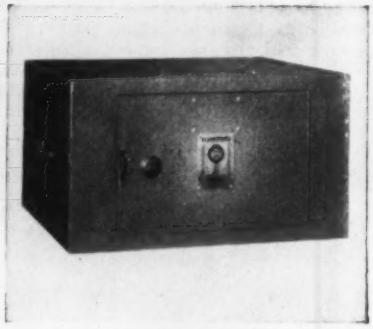


improved ventilating system; convenient run, stop, and reset controls; improved electric circuits; and improved design to assure better accessibility, longer life, and more dependable service. Where former circuits required a positive pulse for timing and a negative pulse for counting, new equipment uses positive pulses for both operations. Instrument may be employed either for microsecond timing or for counting at rates as high as 1,000,000 per second. Results are read directly from illuminated figures; no transpositions or interpolations required. — *Scientific Instrument Section, Radio Corporation of America, Camden, N. J.*

Mention No. 1022 when filling out card.

Sequence Weld Timer

New design of "NEMA 3B Sequence Weld-Timer" permits faster consistent operation and more accurate sequence timing for non-synchronous resistance welders. It also provides easy low range adjustment. Redesigned timer is enclosed in a wall-mounted sheet steel enclosure. Interior (control) panel, with

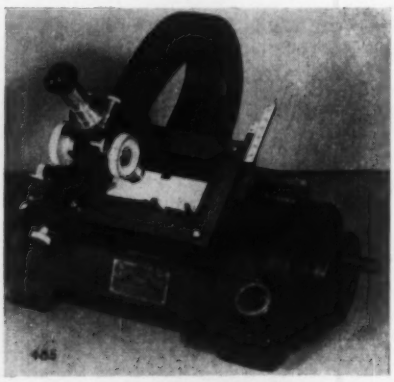


plug-in subassembly construction, is arranged to swing out in a horizontal plane to permit ease of servicing. Time setting dials are arranged for ease of time selection. Rapid-acting relays operate with a minimum time delay to guarantee more accurate timing. Timer is designed for operations up to 450 spots per minute on 20-gage steel. —*Westinghouse Electric Corporation, P.O. Box* 868, *Pittsburgh* 30, *Pa.*

Mention No. 1023 when filling out card.

Spectrogram Comparator

New "Model M1201-30BX Comparator," for measuring spectrograms through a range of 100 mm. to an ac-

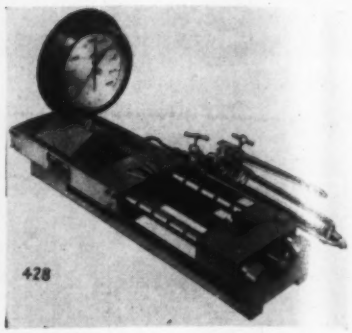


curacy of 1 micron, incorporates cross-motion stage for shifting from one spectrogram to another without changing alignment. Auxiliary carriage provides rapid initial alignment. Microscope power is adjustable from 4× to 34× to give most favorable magnification. Fully enclosed and illuminated scales on coaxial micrometer drums provide readings instantly to five significant figures. Effective range can be extended by shifting plate to left or right on stage and measuring in sections.—*Gaertner Scientific Corp.*, 1201 *Wrightwood Ave., Chicago* 14, *Ill.*

Mention No. 1024 when filling out card.

Portable Tensile Tester

New "Model PO-40 Portable Tensile Tester," for making field tests where conventional testing equipment is not available, is particularly adapted for testing welds where on-the-job testing is preferable; is suitable also for laboratory and for shop testing. Machine has 40,000-lb. capacity; will make tests on specimens from 6 to 13 inches in length and up to 0.37 inch thick and



2.25 inches wide. Its operation is hydraulic, by means of a hand pump integral with base. Adjustable . . . light, slightly over 200 pounds, it can be carried by two men. It is furnished complete with pump (which contains its own oil reservoir) dial gage, and one set of flat jaws; is shipped ready for immediate use.—*Steel City Testing Machines, Inc.*, 8843 *Livernois, Detroit* 4, *Mich.*

Mention No. 1025 when filling out card.

Sound-pressure Measuring Equipment

New "Model GA-1007" sound pressure measurement equipment includes several major improvements over earlier wide-range system. A tiny microphone is permanently attached to the tip of a flexible probe which is, in turn, mounted to a stainless steel base plug that may be assembled to preamplifier as indicated in photograph. Flexible mounting effectively isolates the micro-

phone from the preamplified housing and it is not necessary to handle microphone tip under any condition of use or calibration. A permanent built-in calibrating circuit permits convenient checking of absolute magnitudes of sound pressures from a remote pair of terminals located on panel of the power supply unit. Sound pressures from a few dynes to several million dynes per sq. cm. may be directly measured over frequency range 50 to 250 kc. Wavefronts whose pressure changes occur in periods of only a few microseconds are easily measured with this equipment.—*Massa Laboratories, Inc.*, 3868 *Carnegie Ave., Cleveland, Ohio.*

Mention No. 1026 when filling out card.

Torque Analyzer

New "Livermont Analyzer" is said to be the first and only testing device available for accurately checking tightening capacity, range and adjustment

of powered torque tools. It will demonstrate on direct drives, for example, torque at which clutch releases and at what rate torque increase is accomplished beyond releasing point if held into engagement. On cushion clutch

drives it will show at what torque the clutch releases and begins to impact, at what rate torque is gained after impact starts, and ultimate torque capacity of the tool. On pure impact, it reveals power-delivering capacity of impact (whether air or electric driven), time required to reach a certain torque, and, again, ultimate torque capacity of the tool. A master torque wrench is furnished with each unit; also complete instructions for use.—*Richmont Inc., 2810-12 East 11th St., Los Angeles, Calif.*

Mention No. 1027 when filling out card.

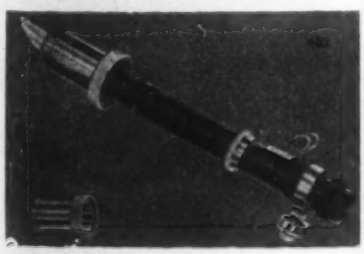
Stainless-steel Dewar Flasks

New improved design in stainless-steel open Dewar flasks is announced. Elimination of all interior seams by helium-arc welding provides greater strength and a smooth unobstructed surface, besides greatly increasing efficiency. Internal wall surfaces are polished to mirror finish and, in addition, flasks feature an exclusive radiation shield also highly polished on both sides. Thus four super-finished surfaces provide a barrier against heat penetration. Vacuum is 0.01 micron. Flasks are available in 26 standard sizes up to 13 by 36 in. I.D. Special units can be constructed to order, also from other metals.—*Hofman Laboratories, Inc., 212 Wright Street, Newark 5, N. J.*

Mention No. 1028 when filling out card.

Dipping Refractometer

New model of Dipping Refractometer has prism mount which provides greater interchangeability of dipping prisms and prevents seepage of liquids and vapors into instrument's compensator parts. Additional prisms may now be purchased and installed without returning refractometer to factory



Improved quality control of metals at **LOWER COST**

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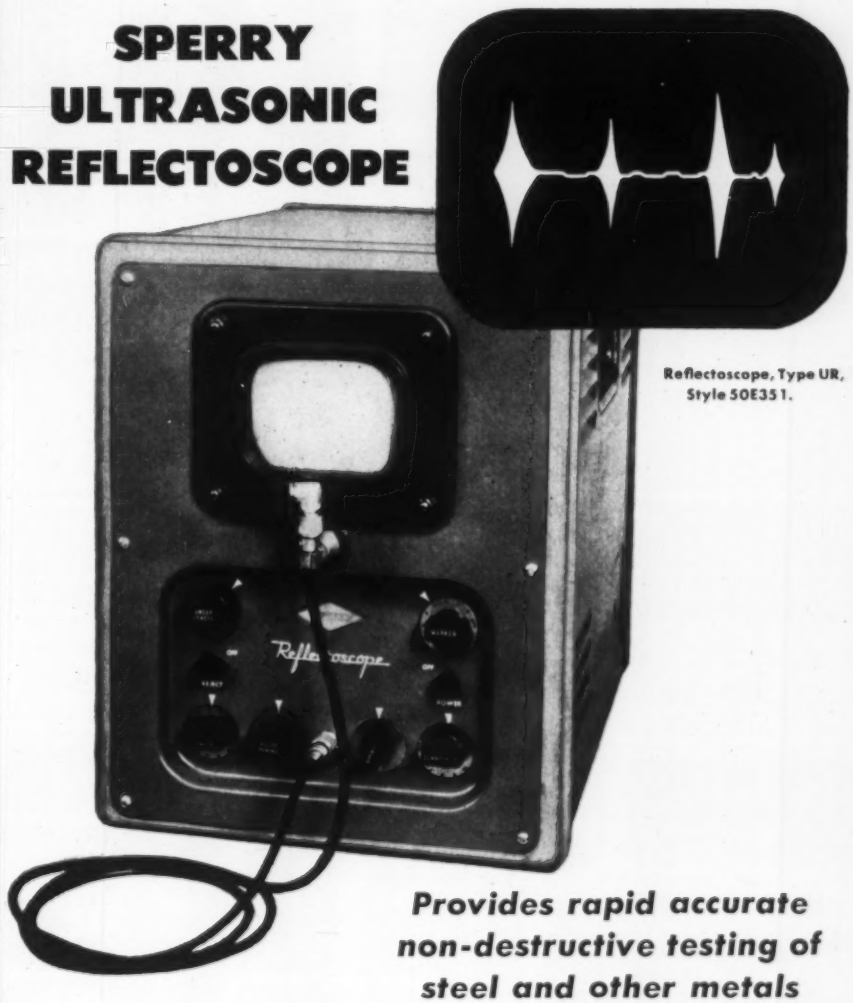

Reflectoscope, Type UR, Style 50E351.

Provides rapid accurate non-destructive testing of steel and other metals

Metals tested by the Reflectoscope are preferred by users who cannot afford lost machine and man hours. The expense of lost work on faulty metals and possibility of service failures are minimized when potentially harmful defects are located before fabricating or machining.

The cost per test is low because it is instantaneous. The operator touches the quartz-crystal Searching Unit to the surface and immediately "sees" through the metal. Discontinuities are revealed on the Reflectoscope screen and are located accurately. For full details write for new Bulletin 50101.

- CONTROLLED SENSITIVITY —can be adjusted to meet quality control standards.
- PORTABLE UNIT — can be set-up quickly by one man.
- TESTS PARTS "IN PLACE" —locates fatigue cracks in shafts, rolls, axles and other stressed parts. Operates on 100-130 volt, 60 cycle current.

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CENTURY Galvanometers are so constructed that they will withstand shocks up to 300 g's, even in the lower frequency units.

Other desirable features of CENTURY Galvanometers include:

LINEARITY:	±2% for ±25° rotation of image at 15½" optical distance.
ZERO DRIFT:	±.0004"/°F. at 15½".
SPOT ADJUSTMENT:	Horizontal spot adjustment is made by rotating the entire Galvanometer within the assembly thus no torsional strain is placed on the suspension. Therefore, damage to the suspension is impossible during spot adjustment.
POLE PIECES:	Flush with tubular case which rotate with the coil when horizontal spot adjustment is made, thus maintaining the flux path across the coil at the correct angle.
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for special fitting and alignment. Sleeve on mount is about 2.5 inches [illegible] g and fits snugly over end of telesc[illegible] tube. Instrument's metal beaker is [illegible]tached by a threaded locking ring t[illegible]assure positive contact with prism [illegible]nount, thereby eliminating leakage a[illegible] evap[illegible] oration of sample. A smaller a[illegible]erture in end of beaker permits light [illegible] enter sample and prism correctly, [illegible]nimiz[illegible] ing stray light. A conical top [illegible]or fo[illegible] cusing eyepiece provides great[illegible] com[illegible] fort to user who wears spect[illegible]cles.—*Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N. Y.*

Mention No. 1029 when filling out card.

Photoelectric Colorimeter

New filter colorimeter is said to represent a departure from ordinary pre calibrated or visual colorimeter. Among

new features. (1) Scale panel calibrated in both Transmission and Density, removable for insertion of other panels calibrated by analyst to read directly for any particular analysis; (2) selected filters covering visible spectrum in six uniform increments of spectral purity; (3) selection of cuvettes from 25 m.m. depth to capillary size; (4) photocell operating at extremely low sensitive levels insuring better linearity, freedom from cell fatigue and accompanying drift.—*E. Machlett & Son, 220 East 23 St., New York 10, N. Y.*

Mention No. 1030 when filling out card.

Pyrometer Controller

New "Electronic Controller," for medium- and high-temperature applications, is designed for use where pre-

cise control is needed or where vibration is severe but added cost of indicating or recording is not justified. Thirteen standard measuring ranges are available. Primary element is a thermocouple; measuring circuit is a

null-balance potentiometer with automatic cold-junction compensation. Unbalance voltages are converted to a.c. and amplified electronically. Control action is continuous and high-speed. Two-position control relay is operated directly by amplifer through trigger circuit for high sensitivity with anti-chatter circuit for positive action. Relay contacts are available for valves, small heating elements, contactors, etc. Entire unit is designed for severe conditions of dust fumes and vibration. Case is designed for either wall or flush panel mounting.—*Loudon Instruments, Inc., 5644 Lake Park Ave., Chicago, Ill.*

Mention No. 1031 when filling out card.

Ultrasonic Generator

New ultrasonic generator for use in research laboratories, provides four vibration frequencies: 300, 500, 750, and 1000 kc., consists of a power unit and a transducer assembly. Controls on sloping front panel of generator cabinet include On-Off switches for high-voltage circuit and filament circuit, a voltage

control to vary power, and an instrument which indicates power supplied to quartz crystal. Transducer assembly, mounted on top of cabinet, consists of a transparent cylinder to hold insulating oil around high-voltage leads. Transducer, or crystal, forms bottom of a test well immersed in the oil. Material to be tested is placed in a beaker or test tube within this well. Generator is 45 in. high, 21 in. wide and 19 in. deep. Test well diameter 1.75 in., 2.625 in. deep. Power input is 500 watts at 115 volts, 50 cycles, while power output is 200-250 acoustical watts.—*General Electric Company, Schenectady 5, N. Y.*

Mention No. 1032 when filling out card.

Gravimetric Chlorine Gas Feeder

New "Model CGS" gravimetric chlorinizer is said to establish new standards of accuracy in feeding chlorine gas to produce chlorine water solutions. It meters and feeds gaseous chlorine by precise and dependable loss-in-weight principle. While particularly suited to

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RECORDING OSCILLOGRAPH

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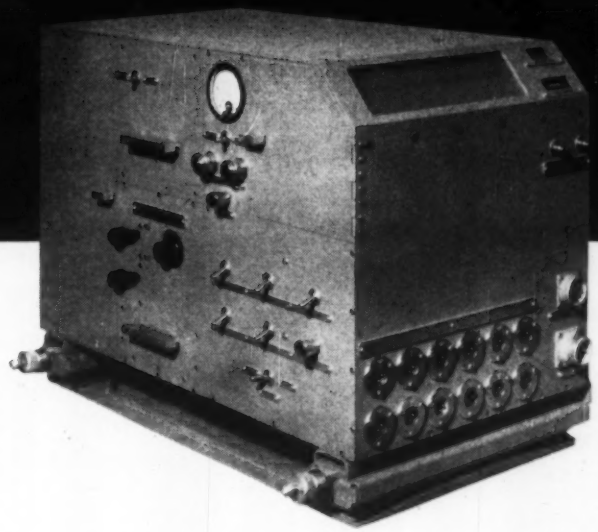
STRESS — STRAIN ANALYSIS

where any or all of the above information is an important factor.



FEATURES

1. 12—50 individual channel recording.
2. Continuous recording up to 200' without jamming
3. Instantaneous changes of recording speeds up to 50" per second with automatic adjustment of lamp intensity.
4. Timing System — Discharge lamp controlled by temperature compensated tuning fork providing sharp .01 second with heavier .1 second timing lines. Conversion to .1 second lines only, by switching.
5. Independent optical system provides constant view of traces with optimum light intensity at all times.
6. Recording lamp under constant surveillance of external condition indicator lamps.
7. Galvanometers — with optional range of frequencies and sensitivities.
8. Electrical — Available for operation from option of 12 or 24 volts D.C., or 110 volts A.C.

OPTIONAL FEATURES

1. Trace identification by means of light interruption.
2. Trace scanning for observation of steady state phenomena.
3. Remote control unit.
4. Automatic record numbering system.
5. Automatic record length control.
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PIPE MOUNTING ¼ to 1 ½ NPT connection—plain and cleanout type.

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AVAILABLE in any machinable metal or material

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FACILITIES—gage stock and instrument calibration to ½ of 1%.

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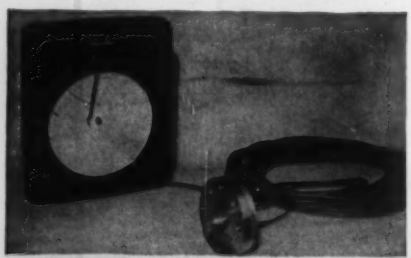

MANSFIELD & GREEN

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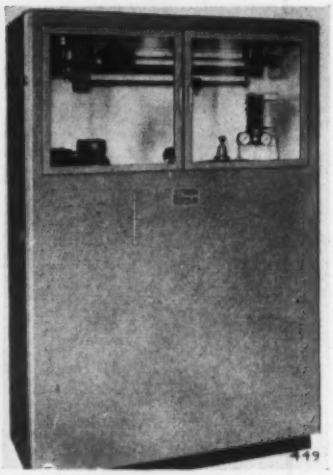
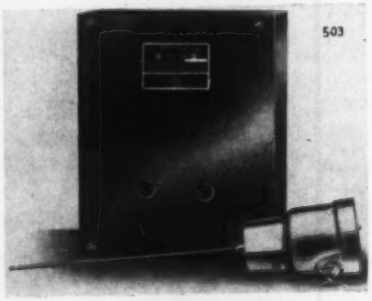


high capacities, it is equally well adapted to exact low rate feeding. Chlorine control cabinet and chlorine weight scale are separate units, interconnected only by small air piping. No chlorine is present at control station.—*Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.*

Mention No. 1033 when filling out card.

Combustion Safeguard

New "Electronic Pyrotrol" protects gas-fired furnaces, boilers, etc., from danger of gas explosions during ignition, operation, and shut-off; performs all of operations of lighting a gas appliance that are recommended for absolute safety. If normal operation fails at any step, lighting-up cycle stops and

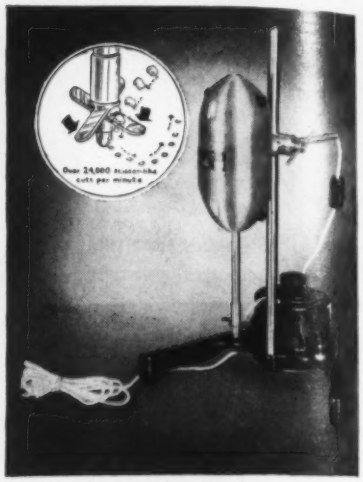


closes any valve that has been opened. If power supply fails, entire system is shut down safe. Relighting is impossible if any tube or relay in "Pyrotrol" fails to function in its normal manner. Safe-start relay prevents gas flow to appliance should there be a leakage path in electrode head or electrode cable of resistance within normal flame operating range. In order to avoid unnecessary shutdowns it prevents gas shut-off due to momentary flame flicker, in accordance with accepted insurance company standards. "Pyrotrol" is offered in six models.—*The Bristol Co., Waterbury 91, Conn.*

Mention No. 1034 when filling out card.

Laboratory Mixer

New "Counter-Rotating Mixer" uses two motors driving two concentric propeller-equipped oppositely-rotating shafts,, hence produces an annular rather than circular flow. Thus, all materials, including heavier particles, are rapidly drawn into propellers where they must pass through shearing zone. There is practically no cavitation, no centrifugal effect, and liquid level remains essentially constant, allowing use of nearly-filled containers. In some tests, materials usually requiring two hours have been thoroughly mixed in less than ten minutes. New mixer al-



lows relative speeds from approx. 200 to 12,000 rpm. continuously variable through a General Radio "Variac." Motors are completely enclosed and all immersible parts are of Type 302 stainless steel, except a bottom guide bearing of leaded bronze. Four high-speed precision permanently-greased ball bearings. Available for either 110- or 220-volt a.c. or d.c., and with shaft lengths and propeller designs as required.—*Brookfield Engineering Labs, Inc., 004 Porter Street, Stoughton, Mass.*

Mention No. 1035 when filling out card.

Pump for Temperature-controlled Baths, etc.

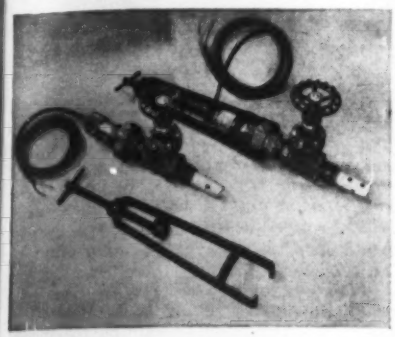
New "Model 10" centrifugal pump, for application where only low volume and pressure are necessary, is said to

be expressly suitable for small temperature control baths, humidifiers, deodorizers, laboratory uses, etc. It is equipped with a 1/1000-h.p. brushless type shaded-pole motor for operation on 110-volt 60-cycle single-phase current. It is rated at 0.7 gpm. on free flow and has a maximum pumping head of 27 inches.—*Production Specialties, Inc., 66 Amity Road, New Haven 15, Conn.*

Mention No. 1036 when filling out card.

Conductivity Cell

New high-pressure insertion-type conductivity cell is equipped with a 0.25-in. bronze gate valve removal de-

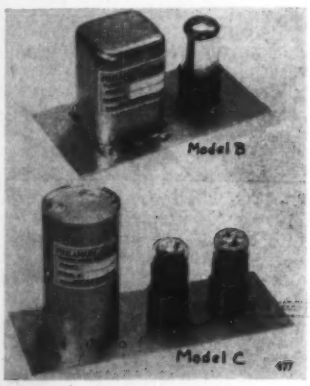


vice for service up to 300 psi. and 200 F. A yoke is supplied for safety in removing element under line pressure. It is provided with platinized electrodes and a ceramic insulator, and is available in cell constants 0.01 and 0.1. New type cell is also available with built-in automatic temperature compensator on systems supplied by makers.—*Industrial Instruments, Inc.*, 17 *Pollock Ave., Jersey City 5, N. J.*

Mention No. 1037 when filling out card.

Tuning-fork Resonators

New temperature-compensated tuning-fork resonators are available in frequencies from 1,000 to 3,000 cps. and



in accuracies from 1 part in 3,000 to 1 part in 100,000. Most accuracies (except 1 part in 50,000 and 100,000), are obtainable for operation without benefit of temperature control over ranges as wide as 100 C. The 1-part-in-100,000 resonator is obtainable for operation over a 55 C. range. If thermostatically controlled ovens are employed, accuracies of the order of 1 part in several million may be realized. Tuning forks are provided complete with their drive and pick-up coils mounted in solder-sealed evacuated steel cans; are thoroughly aged for maximum stability of operation. Resonators are available as individual components, as a part of sub-assemblies, or in completed equipment. — *Philamon Laboratories*, 5717 *Third Avenue, Brooklyn 20, N. Y.*

Mention No. 1038 when filling out card.

Recorder Pen

New solenoid-actuated pen which avoids ink-throwing while providing speedy recording has been developed for use on circular-chart recording poten-

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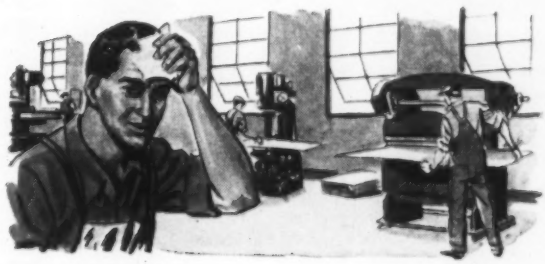

The instrument below is built by the manufacturer of the world's finest meteorological devices—suppliers to the United States Weather Bureau for over 70 years. Its accuracy is unchallenged—and the data it produces can be relied upon to give you exactly the facts you need. Remember, whatever your needs for weather data, or wherever you need to collect them, Bendix-Friez makes the best instruments for the purpose.

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Portable Humidity and Temperature Recorder, Model 160—

3" x 5" charts, 8 or 30 hour records. Modern design . . . handy for small space and difficult locations . . . built to meet unusual conditions.

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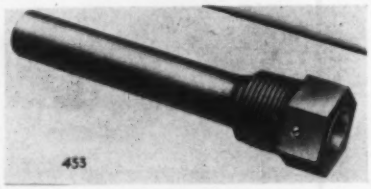
F & P makes FLOW meters for slurries; viscous, corrosive, and abrasive fluids; 0.01 cc/min to 10,000 gpm; temperatures from −350°F to +1500°F; pressures to 10,000 psig.

tiometers. It makes use of an amplifying linkage designed so that solenoid's high-velocity reaction is almost spent before pen is picked up and moved. Pen is a V-type, holding a five-day supply of recording ink.—*Brown Instruments Div., Minneapolis-Honeywell Regulator Co., Philadelphia* 44, *Pa.*

Mention No. 1039 when filling out card.

Thermostat-bulb Socket

New stainless-steel "Thermowell" offers suitable protection for maker's "Thermoswitch" thermostats which



must operate under adverse conditions, without affecting functioning of thermostat unit. It protects against excessive pressures; physical blows; attack by corrosive liquids or atmospheres; abrasion; ambient effects which might influence functioning when thermostat head protrudes from medium being controlled. It permits removal of thermostat from tanks or other containers without need for removing liquids or gases they contain. Six basic types are offered in standard and heavy-duty models.—*Fenwal Inc., 3 Main St., Ashland, Mass.*

Mention No. 1040 when filling out card.

Automatic Water Feeder

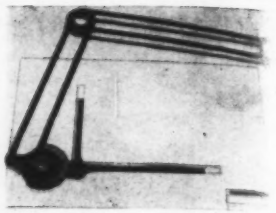
New make-up water feeder has been developed for use on receiving tanks of boiler return systems. Features are

straight-trust cam-and-roller valve action which provides tight closure against water supply pressures up to 150 psi.; stainless steel valve and seat; large integral strainer, flange-mounted for easy cleaning. Feeder is made with three patterns of mounting flanges, one of which will fit openings provided in most receiving tanks.—*McDonnell & Miller, Inc., Wrigley Bldg., Chicago* 11, *Illinois.*

Mention No. 1041 when filling out card.

Drafting Machine

New "Model D Wrigraph Drafting Machine" eliminates all obstructions along top edge of drawing area; mounts

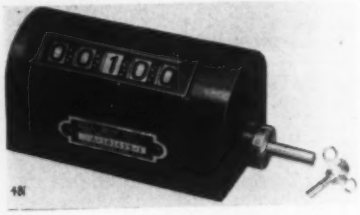


in extreme right-hand corner of drawing board instead of center or left corner; permits free movement of scales over entire drawing area without interference. It is a portable unit for individual use. Drawing area is 20 x 26 inches. Machine is easily fastened to any board or table; is available in two sizes.—*L. G. Wright, Inc., P.O. Box* 63, *Cleveland* 21, *Ohio.*

Mention No. 1042 when filling out card.

Dual-purpose Counter

New "Duo-Cam Counter" developed chiefly for such uses as size-grading operations, to count the number of pieces

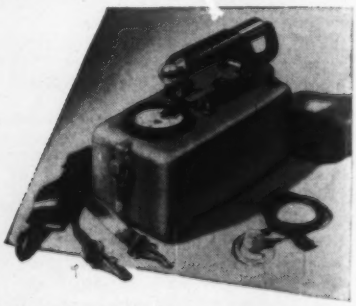


graded, on can-closing machines, etc., can be supplied both as a revolution ratchet counter (adding one count for each revolution of drive shaft in either direction) and as a ratchet with stops counter (made to order only, adding one count for each oscillation of lever through a 30-degree angle). Maximum recommended speed of revolution ratchet type is 200 counts per minute; of ratchet with stops type, 500 counts per minute. Shaft is at right side, with top coming or going. Reset by clock key.—*Veeder-Root, Inc., Hartford, Conn.*

Mention No. 1043 when filling out card.

Radiation Survey Meter

New "Keleket Model K-800 Beta-Gamma Counting Rate Meter" has a Geiger-Mueller tube in a probe as de-



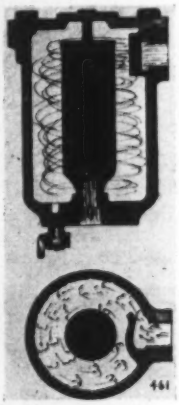
tector element, is completely waterproof and built into a cast magnesium-aluminum case for ruggedness. Tube probe has a movable shield to differentiate between beta and gamma radiation. This feature is achieved without conventional interspread foils; shield is stainless steel, two millimeters thick and will exlude all but highest-energy beta rays.

Three ranges of gamma activity may be measured. A scale selector switch permits choice of 0.2, 2.0 and 20.0 mr/hr. Scale is also calibrated in 360, 3600 and 36,000 counts per minute. An earphone is provided for aural monitoring. New "K-800" comes completely assembled and ready to operate.—*Instruments Division, The Kelley-Koett Mfg. Co., P-2217 W. Fourth St., Covington, Ky.*

Mention No. 1044 when filling out card.

Air Filters

New "Centrisorb" air filters combine three basic methods for cleaning air stream. As air enters filter chamber it is given a tangential swirling motion which throws most of particles of oil and water against walls of chamber, whence they drain to bottom of



chamber. Air then passes through porous stainless steel cartridge filled with S/V Sovabead. Porous stainless steel removes remaining particles of liquid which also drain to bottom. Any oil vapors which pass porous stainless steel are adsorbed by Sovabead. Automatic trap is available to drain accumulated liquids from filter chamber. Filters are available in sizes from 0.75-in. pipe (50 scfm. 80-125 psig) to 3-in. pipe (1000 scfm. 80-125 psig)—*Industrol Corp.*, 88-35 76th *Avenue, Glendale, Brooklyn* 27, *N. Y.*

Mention No. 1045 when filling out card.

Thin Mica Geiger Counter

New "Model D31" thin-mica end-window counter has a plateau length of 200 to 300 volts, with a slope of only 3 percent per hundred volts. Threshold voltage is between 1050 and 1300 volts, and counting life is at least 10^8 counts. Standard four-prong socket fits into maker's and other mounts and shields. "Model D31" Counter is available with

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In the interest of safety, this railroad had appropriated money to rebuild a bridge suspected of being too weak to withstand the weight and shock of modern high-speed trains. Weights could be computed, but vibrational stresses presented an unanswerable problem.
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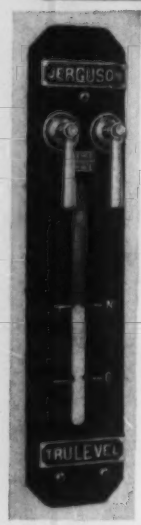

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For All Distant Reading Problems

JERGUSON TRULEVEL Gages are the ideal solution to your problem when you need to read boiler water level accurately at a distant point, as in the case of inaccessible waste heat boilers.

TRULEVEL brings the liquid level reading of water, or of any condensing medium which you may be using, right down where you can see it. Complete accuracy of reading is assured by the use of a new type datum column, located at the drum.

Quick checking at the distant reading point is another important feature of TRULEVEL, and this is patented and exclusive with Jerguson. By simply turning the two valve handles on the cover it is possible to check gage accuracy *in a matter of seconds.* For accuracy and safety use the Jerguson TRULEVEL.

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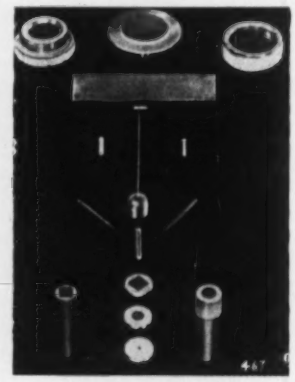
window thickness from 2 to 3.9 milligrams per square centimeter; "Model D32" between 1.5 and 2.0 mg. per sq. cm.—*Nuclear Instrument & Chemical Corp., 223 West Erie St., Chicago 10, Ill.*

Mention No. 1046 when filling out card.

Radiation "Area Sources"

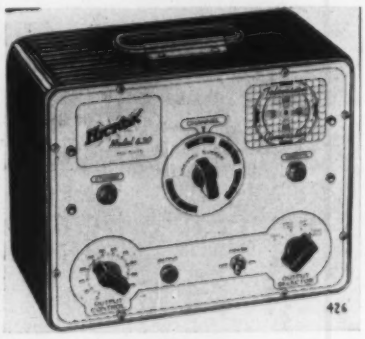
New radiation "area sources" have been developed to aid standardization of instruments used to detect or measure nuclear forces. Each of the units shown, from pin points to various measured areas of radiation surface, has been specifically designed to furnish alpha, beta or gamma particles at an accurately known rate. In most cases, radium is the source, but other long-lived radioactive materials may also be used.—*United States Radium Corp., 535 Pearl St., New York 7, N. Y.*



Mention No. 1047 when filling out card.

TV Linearity Pattern Generator

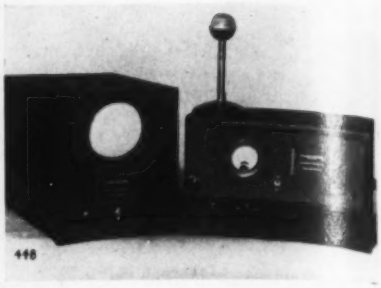
New "Model 620" portable linearity-pattern generator provides an independent video pattern at any time for TV receiver screen alignment and servicing; is more accurate than broadcast pattern for most sets; is rapidly connected directly to antenna of any TV receiver; permits technicians to service rapidly and more accurately in borderline fringe areas. Alignment can be done when a broadcast pattern is not available.—*The Hickok Electrical Instrument Co., 10519 Dupont Avenue, Cleveland 8, Ohio.*



Mention No. 1048 when filling out card.

Voice Spectrum Visualizer

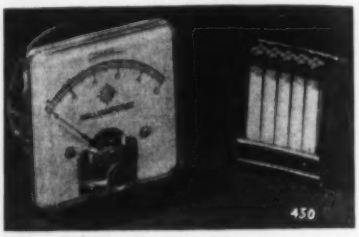
New "Sonalator" provides an instantaneous display of frequency and energy vs. time in a CR tube screen. This dynamic visible speech translator permits any wave containing frequencies between 100 and 4000 cps. to be analyzed, by means of 29 crystal filters each 135 cps. wide, whose outputs are rapidly scanned by electronic methods in synchronism with vertical sweep on "Sonascope" tube. Horizontal sweep of long-persistence tube in "Sonascope" produces time axis. "Sonalator" can be used also for medical studies (cardiography, encephalography), vibration and noise studies; can easily be modified for supersonic work.—*Kay Electric Company, Pine Brook, N. J.*



Mention No. 1049 when filling out card.

Miniature Electrical Instruments

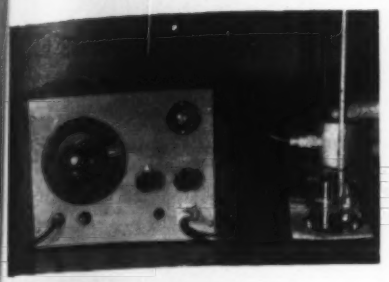
New design of electrical indicating instruments features a clear plastic case for modern appearance and is interchangeable with present 2.5-in. types. Case is molded of Koppers P-8 heat-resistant crystal polystyrene. Front measures 2.44 in. high x 2.63 in. wide; barrel diameter is 2.46 in. Scale arc length is 2.5 in. Movements have Alnico-V magnets for maximum strength or chrome steel for economy. Available in a wide variety of ranges from 20 microamperes to 50 amperes and 5 millivolts to 500 volts. Rectifier type a-c. ranges and r-f. types are also supplied. Both front and back of case are clear so that inside can be easily examined without removing case.—*Assembly Products, Inc., Main & Bell Sts., Chagrin Falls, Ohio.*



Mention No. 1050 when filling out card.

Dielectric-constant Apparatus

New Dielectric-constant Meter for liquids, for demonstrating principles related to this property, is said to be the first low-cost commercially-available instrument of its kind. It permits measuring with one external probe the full range of dielectric constants from unity to 85. Basically it uses a calibrated capacitor to measure changes in external capacitance (probe). A seven-position switch in probe circuit introduces a predetermined change in capacitance, this change being measured on standard capacitor as differences between readings. Readings of constants from 1 to 25 are accurate within 1 percent, accuracy decreasing to 5 percent at a constant of 80. A pair of readings is made with probe immersed in liquid

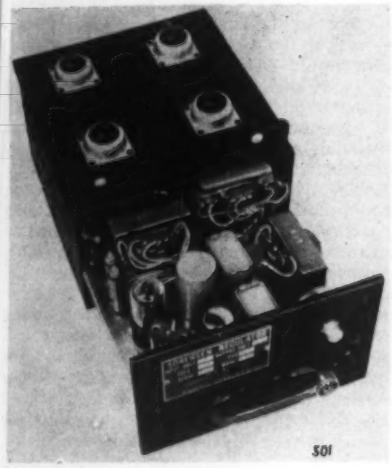


of unknown constant and a corresponding pair of readings is made with probe in air. Difference in readings taken in liquid divided by difference recorded in air is dielectric constant for the liquid, because constant for air is unity. Increments in external capacitance are read by tuning circuit to resonance with the standard capacitor, proper tuning being indicated by a sharp wink of the eye tube as oscillation begins.—*Yellow Springs Instrument Co., Inc., Yellow Springs, Ohio.*

Mention No. 1051 when filling out card.

400-cycle Voltage Regulators

New group of a-c. line electronic voltage regulators and d-c. supplies operate from 115-volt 400-cycle lines. Since



these units are specially designed for use in aircraft, emphasis is placed on compactness and light weight. Three-phase regulators and higher-capacity single-phase units are in final-design stage; but enough of certain types are already in production to consider them as standard. In general, specifications are: Input voltage range, 95-215, 400 to 800 cps.; output voltage, adjustable between 100 and 120; regulation accuracy, 0.5 percent; power factor range, down to 0.7. Single-phase a-c. regulators are now available to 50, 100, 250, 500, 1200, 2000 and 2500 va. One regulated d-c. supply working from a 400-cycle line is now ready, rated at 28-volt d-c. output with a load range of 2.5 to 10 amperes; regulation accuracy 0.5 percent.—*Sorensen & Co., Inc., 375 Fairfield Ave., Stamford, Conn.*

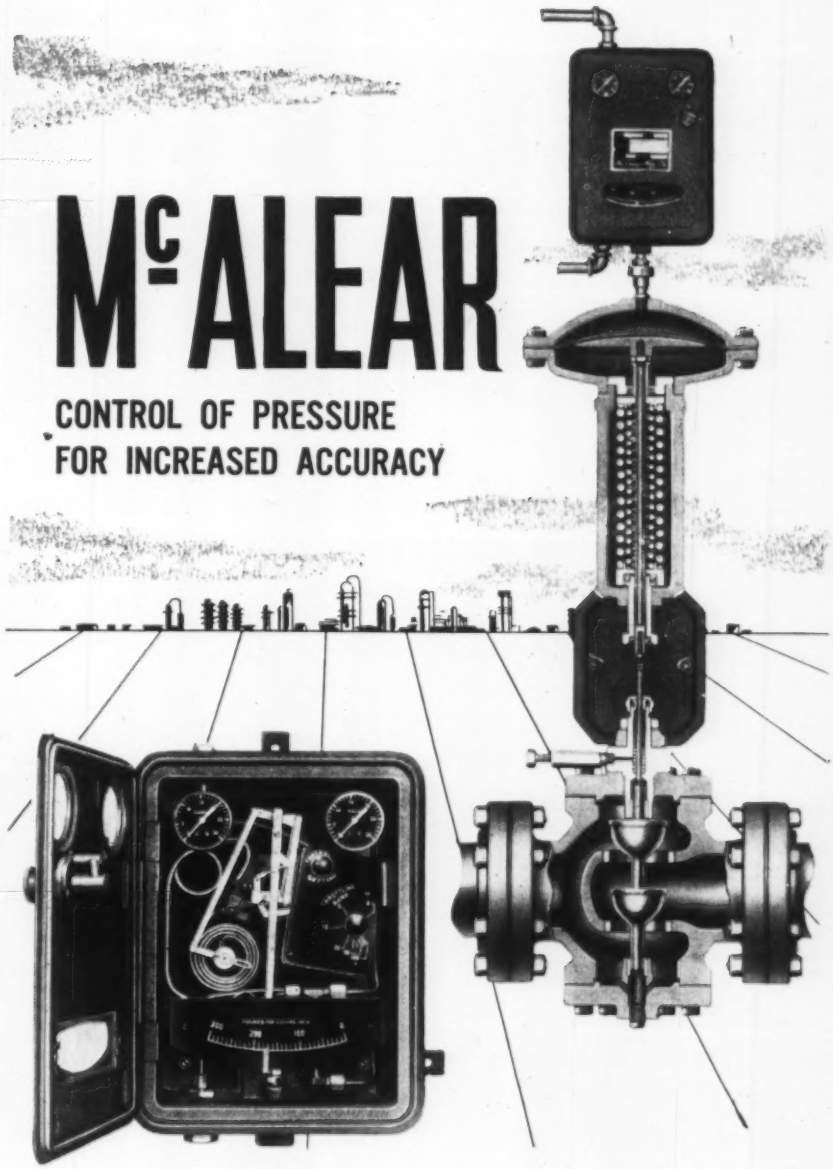
Mention No. 1052 when filling out card.

Flow Regulator

New "Kates Regulator" has only one moving part, will hold any pre-set flow volume constant while upstream pressure may vary over a 100-psig range, Regulating unit is contained in a vertical cylindrical case having a valve

McALEAR

CONTROL OF PRESSURE FOR INCREASED ACCURACY



These McAlear units offer a completely coordinated "package" for installation wherever sensitivity of control is required.

McAlear No. 115 and No. 116 Diaphragm Motor Valves—Equipped with ball bearings and multiple springs. No. 115 is spring opened and pressure closed while No. 116 is spring closed and pressure opened. Available in semi-steel or cast steel, or other metals, suited to various pressures, temperatures and services. Sizes from ½" to 12".

McAlear No. 1500 Pilot — Employs spiral sensitive spring which reduces hysteresis to minimum. Adjusted or converted to reverse action without use of tools. Indicator shows controlled pressure. May be mounted on valve or remotely (surface or flush) without alteration. Full range of operating pressures available. Write for Bulletin No. 150.

McALEAR Mfg. Co.
1915 SOUTH WESTERN AVENUE
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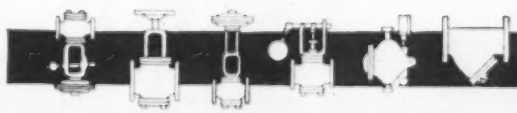

McALEAR controls for STEAM WATER AIR OIL-GAS

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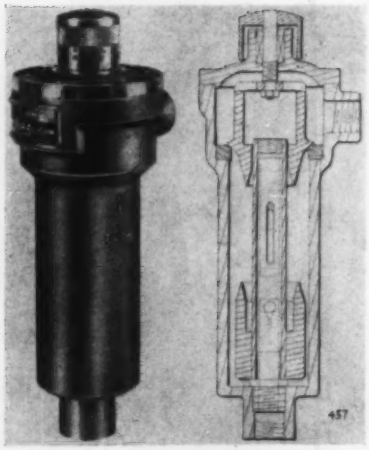
seat and disk in a partition near upper end. An opening in center of valve disk forms a differential-pressure orifice and a movable disk concentric in this orifice opens and closes a high-pressure valve in lower part of case; thus constant differential pressure (and the constant flow causing it) is regulated by the small central disk and orifice. This constant differential pressure also exists across the surrounding valve as well, and causes constant and regulated flow through it as well as through central orifice. Change of opening of this surrounding valve provides variation of flow through regulator in direct proportion to area of opening. Usual threaded valve-stem adjustment thus gives a linear scale of gpm. flowing. Only moving part is movable disk in orifice and high-pressure valve directly connected to it. This assembly is rigid



and "floats" vertically without [illegible] except by the balancing forces [illegible] pressure differential and gravi[illegible] New regulator is easily installe[illegible] with wrenches, is applicable to fu[illegible] lines, injection, blending, backwash a[illegible] rinse control in water treatment [illegible] talla- tions, and a wide range of [illegible] mical plant problems.—*The W. A. Ko[illegible] Co., Deerfield, Illinois.*

Mention No. 1053 when filling ou[illegible] card.

Amplifier for Aircraft [illegible]

New "Type 140-AHl. Microse[illegible] d-c amplifier, for use in aircraft, [illegible] de- signed to operate with 26.5 volt[illegible] d-c

power supply. Bipolar output of 3.0-ma. d.c. is obtainable in each of five fixed ranges corresponding to input signal voltages of 75, 150, 187.5, 250, and 750 mv. with a sixth variable range permitting adjustment of sensitivity to any value between 75 and 750 mv. Zero-center operation is inherent and output polarity corresponds to that of input without use of reversing switches. Operation is substantially independent of aircraft service conditions and grounding either side of input or output does not affect operation. Shock-mounted unit is 7 in. high, 5.5 in. wide, 9.5 in. long; weighs approx. 6 pounds.—*Manning, Maxwell & Moore, Inc., Bridgeport 2, Conn.*

Mention No. 1054 when filling out card.

TV Power Supply

New RCA "Type TY-25A Regulated Power Supply" provides well-regulated d.c. at loads from 200 to 300 milliam-

peres; output adjustable between 260 and 290 volts, with variations of less than 0.5 percent from minimum to maximum load. A-c. ripple less than 0.01 percent from peak-to-peak. Power requirement is 120 volts, 60 cycles, 300 watts.—*Television Section, RCA Engineering Products Dept., Radio Corporation of America, Camden, N. J.*

Mention No. 1055 when filling out card.

Remember . . .

BOOTH NO. 206 AT THE ST. LOUIS SHOW

GORMAC

SPECIALIZES IN PRECISION COMPONENTS FOR INSTRUMENTS

Using the latest models of improved American-built Swiss-type Automatic Lathes, Gormac produces close tolerance multiple diameter parts of .005" to ½" in diameter and in lengths of from .032" to 7". Front and back tapers turned to tolerances and finish which would normally have to be ground in a second operation to obtain the same results. Multiple diameter parts of long, slender characteristics held concentric, one diameter with another, in tenths of thousands of an inch — full indicator reading. Cam layout, cams, tools and accessories for Swiss Automatics. No charge for estimates. Send us your prints and quantities required.

GORMAC PRODUCTS, INC.

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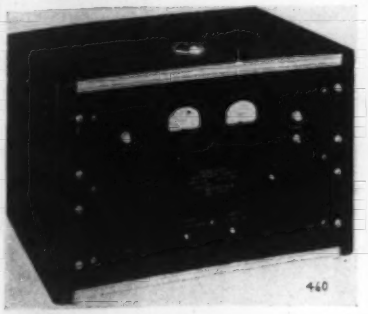
RACINE WISCONSIN

Twin Power Supply

New "Model 1210 Twin Power Supply," for laboratories, test-stations on production lines, etc., produces d-c. power at constant output voltages, independent of variations of power-line voltage and of currents drawn by load. Feature is said to be that a switching arrangement not found in other electronically regulated power supplies enables one single unit to do

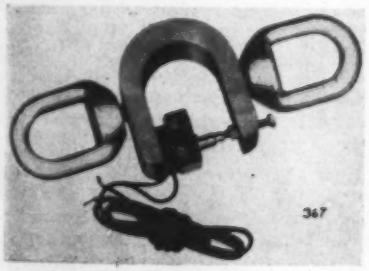


the job of two separate supplies at a price not much higher than that of a single unit. Output voltages (0 to 500 v.dc. at 0-150 ma.) can be adjusted by operation of two control-knobs. A selector-switch allows two ways of operation: (1) two independent outputs which can be used independently of each other; (2) one single output capable of supplying twice this current, obtained by connecting both regulator circuits in parallel. In addition, a "stand-by" position on selector-switch is provided for use when voltage should be removed from high-voltage terminals. These two independent outputs have a common negative terminal, but whole system is floating and any point may be grounded externally. Two low-voltage a-c. power outputs, available from another set of terminals for operation of tube filaments or heaters, are obtained from separate center-tapped insulated windings of unit's power-transformer and may be connected to any desired potential. — *Furst Electronics, 12 S. Jefferson St., Chicago 6, Illinois.*

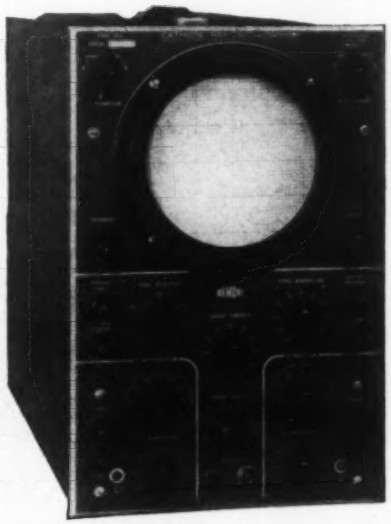
Mention No. 1056 when filling out card.

Overload Switch for Cranes and Hoists

New "Dyna-Switch" is designed to protect hoists or cranes from accidental overloads. It slips onto hoist or crane hook, and load is lifted in usual fashion. U-shaped bar opens and closes circuit of a Burgess Microswitch as loads are lifted. Normally, circuit of switch is



closed when loads are being lifted. If hoist capacity is exceeded, circuit opens, cutting out motor and thereby preventing lift. Circuit remains open until op-



It's a lot easier with the right-sized screwdriver!

LIKEWISE . . .
Your CATHODE-RAY oscillography can be a lot easier with the

Du Mont Type 304-H
CATHODE-RAY OSCILLOGRAPH

★ Make it the *easier* and *better* approach to those mechanical problems involving pressure variations . . . timing of slow-moving parts . . . minute vibrations . . . complete monitoring of overall operations . . . small displacements . . . and many other applications. Use the new Du Mont Type 304-H Oscillograph because of such features as:

HIGH-GAIN AC and DC AMPLIFIERS . . .
Both X- and Y-Axes have AC and DC amplifiers. Y-Axis sensitivity is 10 millivolts rms per inch; X-Axis is 50 millivolts rms per inch. Frequency response of the DC amplifiers is uniform within 10% from 0 to 100,000 cps; of the AC amplifiers, within 10% from 20 to 100,000 cps. Stability of these amplifiers is excellent, and microphonics and drift are at a minimum.

RECURRENT AND DRIVEN SWEEPS . . .
Variable from 2 to 30,000 cps, with provision for readily obtaining sweep durations of ten seconds or more by use of external capacitors.

EXPANSION OF DETAIL . . .
Available deflection over 5 times full-screen diameter, with no visible distortion when positioning over the entire range. This gives big-tube visibility with small-tube resolution.

INCREASED ACCELERATING POTENTIAL . . .
Du Mont Type 5CP-A Cathode-Ray Tube used is operated at overall accelerating potential of 3000 volts, fully utilizing long-persistence screens, low-frequency sweeps, and DC amplifiers.
Type 304 Cathode-Ray Oscillograph, having identical characteristics except for lower accelerating potential, is also available at slightly less cost.

STABILIZED SYNCHRONIZATION . .
Both sweep length and synchronization level are maintained as signal amplitude varies.

INTENSITY MODULATION . . .
15 volts peak input at the Z-Axis terminal will blank a trace of normal intensity.

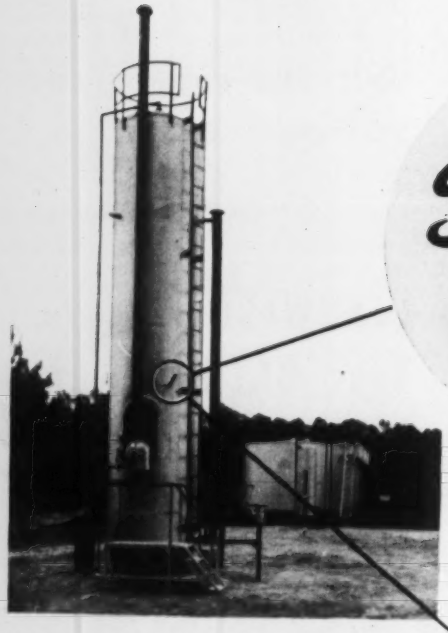
ADDITIONAL FEATURES . . .
Engraved, permanently mounted calibrated scale for precise quantitative measurements. Mu-metal shield for Type 5CP-A tube. Du Mont 2501 Bezel for attaching photographic accessories.

MECHANICAL DETAILS . . .
Height, 13½"; Width, 8½"; Depth, 19"; Weight, 50 lbs.

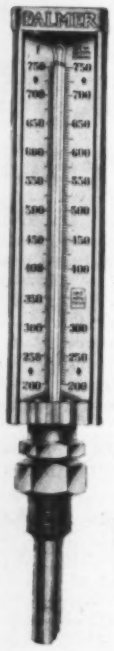
★ Descriptive 12-page bulletin on the new Type 304-H Oscillograph is yours for the asking. Just address . . .

DUMONT *for Oscillography*
ALLEN B. DU MONT LABORATORIES, INC. PASSAIC, N. J.
CABLE ADDRESS: ALBEEDU, NEW YORK, N. Y., U. S. A.

Instrument Division, 1000 Main Ave., Clifton, N. J.



Small... but so important!



Above: An oil field oil-water emulsion treater, with Palmer Thermometers "on guard."

JUST a small part of your process equipment, but vital as a heartbeat is your watchful Palmer Thermometer . . always on guard . . . guaranteed accurate . . . permanently.

It's easy to take accurate readings on a Palmer, too. With 'Red-Reading-Mercury', the silvery mercury stands out as a highly visible, wide red column. Full length, graduated scale.

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MOISTURE REGISTER COMPANY

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erator presses switch to reve[illegible]e. He must then remove excess loa[illegible] before hoist will pick up. Hoist moto[illegible] up to ¾ hp. can be handled dire[illegible]ly by "Dyna-Switch," higher capaci[illegible]s are worked through an intermediat[illegible] relay. —*W. C. Dillon & Co., Inc.,* [illegible]10 W. *Harrison St., Chicago* 44, *Illinoi*[illegible]

Mention No. 1057 when filling ou[illegible] card.

Mutual Conductance Tube Tester

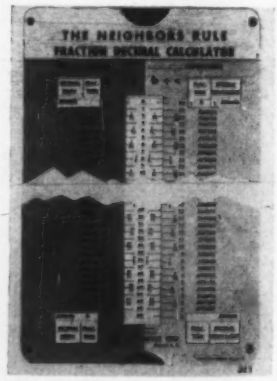
New "Model 600" lightweigh[illegible] portable tube tester utilizes Dynam[illegible] Mutual Conductance circuits, said to be

the most accurate test of an AM, FM, or television tube. Scale readings are directly in micromhos. Ranges: 0-3000-6000-15000 micromhos. Instrument tests all tubes, is housed in portable case 7.5 x 11.75 x 16.75 in.; weight 15 lbs.—*The Hickok Electrical Instrument Co.,* 10519 *Dupont Ave., Cleveland* 8, *Ohio.*

Mention No. 1058 when filling out card.

Fractions and Decimals Calculator

New "Neighbors Rule" produces instant answers in addition and subtraction of fractions and decimals, and converts either way, as related to use of

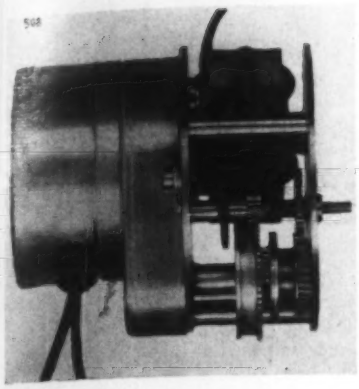


blueprint and micrometer readings and decimal equivalent problems. It therefore saves time in eliminating necessity of resorting to pencil and paper.—*United Tool Service Corp.,* 549 *W. Randolph St., Chicago, Ill.*

Mention No. 1059 when filling out card.

Timing Motor

New "Type SXC" synchronous motor, with differential clutch mechanism, meets needs of many timing, recording, indicating and switching applications requiring an accurate reset operation. It produces 30 in. oz. of torque at 1 rpm. Magnet engages internal gear from a 4-1 step-off so that clutching force is one-fourth that which would be normally required if engaged

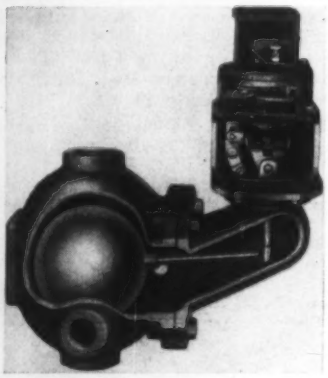


directly. Can also be furnished with a reverse clutch that engages when magnet is deenergized. Size, approx. 2.06 in. x 3 in. Thirty-nine output speeds are available from 15 rpm. to one rotation in four days.—*The R. W. Cramer Co., Inc., Centerbrook, Conn.*

Mention No. 1060 when filling out card.

Low-water Cut-off

A new "No. 63" low-water fuel cut-off, for automatically-fired boilers carrying up to 50-lb. pressure, is designed

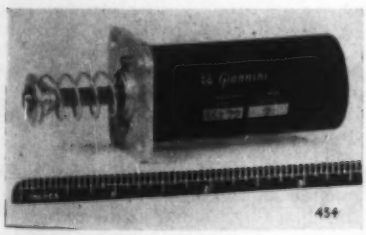


for installation with 1-inch equalizing piping (method of installation best adapted to hot-water boilers); also recommended for automatically-fired steam boilers in middle range of pressures from 20 to 50 lbs. Among features: all working parts isolated from heat of float chamber; sylphon bellows eliminates packing, is up out of water; all other working parts non-corrosive materials; switch proper is "McDonnell No. 2" snap-action type.—*McDonnell & Miller, Inc.*, 1368 *Wrigley Building, Chicago* 11, *Ill.*

Mention No. 1061 when filling out card.

Dual Rectilinear VDR

New "Rectipot" is a dual rectilinear voltage-dividing resistor comprising two parallel straight-line resistance units, each with a contacting brush, these two resistors being electrically in-



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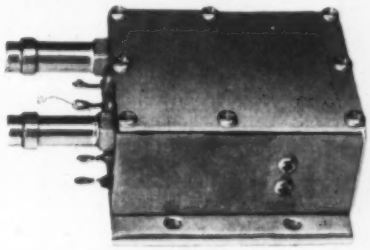

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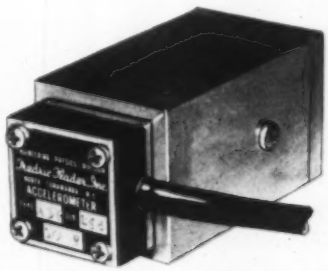

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USE TELEFLIGHT Bonded Strain Gage Instruments! . . .

- *No* unbonded strain gage elements to fail under fatigue or to give *spurious* signals under shock or vibration.
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- *Imperceptible* zero shift with time or temperature change.
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- *Sensitivity* normally in excess of Army-Navy specifications.
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- *Lower* cost instrumentation with *greater* accuracy, reliability, and ruggedness.

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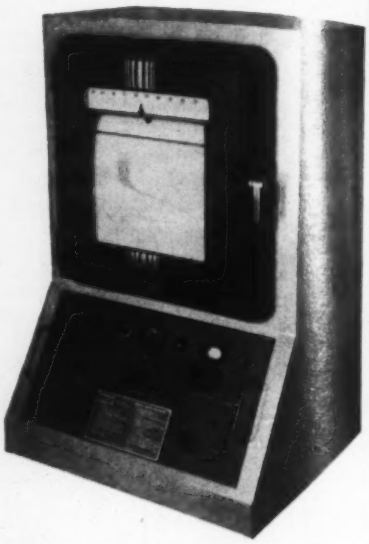
dependent but mechanically connected. "Rectipot" measures 1 inch in diameter, its length depending upon stroke, which may vary from 0.5 to 2.5 in. Resistance units may be wound for resistances of 1000 to 10000 ohms.—*G. M. Giannini & Co., Inc., 697 Morris Turnpike, Springfield, N. J.*

Mention No. 1062 when filling out card.

Polarographic Analysis Equipment

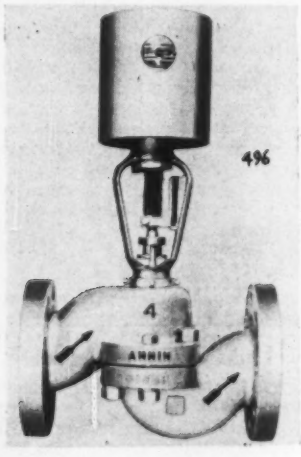
New "Type E Electro-Chemograph" features one-piece console design incorporating a built-in "Speedomax" recorder, is convenient for both research and industrial process control laboratories. Like previous model, it automatically plots diffusion current as a function of voltage, but data-taking is done by a "Speedomax Microampere Recorder" and a typical test run can be made in about half previous time. Various test techniques are available through controls centralized on one panel. Step-by-step instructions for operation, testing and calibration are included on front of instrument. Choice of four degrees of damping enables user to obtain a record that presents qualitative and quantitative data in desired detail. Eleven current ranges cover full-scale readings of 1 to 100 microamperes. There are three polarizing voltage ranges: 0 to —2, —1 to —3 and +1 to —1 volts. To cover both anodic and cathodic polarization, any of these ranges can be reversed in polarity. Time to run through a polarizing range is ten minutes. Voltage can be adjusted to 4 mv. by calibration against an integrally-mounted standard cell. Where desired to obtain several different diffusion current curves on one chart for intercomparison, recorder zero can be readily shifted to separate individual curves. Equipment is shielded against electrical pick-up; is not affected by vibration. Normally it is supplied for a-c. operation, but it can be supplied for use with a battery for polarizer.—*Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.*



Mention No. 1063 when filling out card.

Electro-pneumatic Solenoid Valves

New "1520 Series" solenoid-operated valves are for controlling fluids at pressures up to 3000 psi. Using a secondary pressure source such as air, gas or liquid at relatively low pressures through a 3-way pilot solenoid, control valves in sizes 0.75 in. through 8 in. are readily operated. Incorporation of "Anico Teflon Seat Seal" permits maker to guarantee positive, dependable bubble-tight shutoff through many thousands of operating cycles. New valves are available in Type 316, carbon steel, stainless, Durimet 20, Hastelloy B, C and D, nickel and Monel. Simplified valve body construction with smooth flow passages minimizes pressure loss at high flow rates and makes new



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CIRCULAR DIVIDING MACHINE

For production ruling of precision circular scales according to any standard pattern of lines having industrial or scientific application. Fully automatic. Up to 60 lines per minute on horizontal, beveled or cylindrical surfaces.

Early Delivery

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valves especially suitable for controlling heavy fluids which carry solids. These cylinder-operated valves may also be operated from manual 3-way valves; also from pneumatic, hydraulic and electrically-operated instruments. —*The Annin Co., 3234 Mines Ave., Los Angeles, Calif.*

Mention No. 1064 when filling out card.

Instrument Air Dryer

New "Type A Hydryer" for continuous drying of instrument air or other gases to minus 40 F. dew-point features reactivation of absorbent by a split stream from entering air. Among claimed advantages: (1) entire system operates under one pressure; (2) no moving parts; (3) reactivation air preheated to assure complete heat transfer throughout absorbent bed and

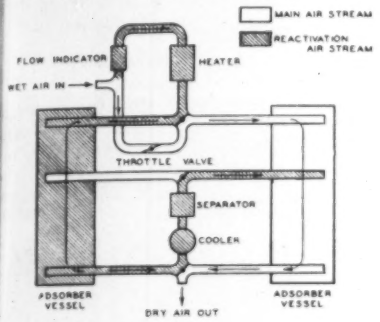


Fig.1 FLOW DIAGRAM 518

maximum efficiency of reactivation; (4) all reactivation air recovered and dried to minus 40 F. dew-point, therefore no loss of air; (5) steam heating: no elec-

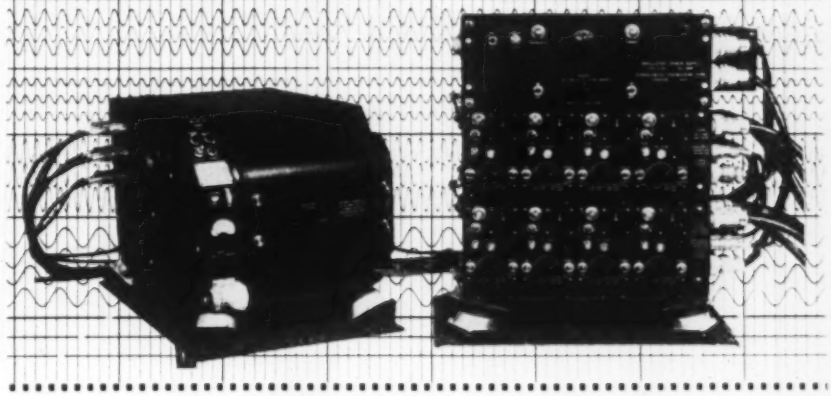
trical parts, unit advantageous for hazardous locations; (6) no external stream being required for reactivation, contamination is impossible: important in drying gases where purity is vital. Flow diagram, Fig. 1, shows process for both drying and reactivation cycles. Fig. 2 shows a 500-scfm "Type A Hydryer." New units are available in sizes for air flows from 10 to 1500 scfm.—*J. F. Pritchard & Co., 908 Grand Ave., Kansas City, Mo.*

Mention No. 1065 when filling out card.

Sectional Terminal Blocks

New sectional terminal blocks of single-circuit type can be assembled into strips of any length from one to 75 pairs of terminals. Units are twisted into a keystone-type mounting channel. Intermediate units can be removed

PRECISION TESTING



CONSOLIDATED SYSTEM "D"

A combination linear, integrating, and 3-kc-carrier multichannel recording system operating with a Consolidated Recording Oscillograph.

ACCURATE MEASURING AND RECORDING of both static and dynamic quantities such as stress, strain, pressure, acceleration, and vibration over a frequency range of zero to 2000 cycles by dependable Consolidated instruments assures many progressive companies that their products are designed for maximum durability, life, and safety, as well as economy of size, weight, and cost.

Consolidated System "D", illustrated above, is a dual-purpose recording system. Two types of amplification are available; the Type 1-112 Amplifier (linear and integrating, 5-2000 cps) for use with self-generating sensing devices or d-c excited strain gages, and the Type 1-113 Amplifier (3-kc-carrier, 0-300 cps) used with carrier-excited pickups. Each of these amplifiers is built as a unitized, single-channel instrument. The system, comprising eight channels, may be made up of either type of amplification or a combination of both. A Consolidated Recording Oscillograph, providing graphical records containing from one to 36 channels of information, completes the system.

Write for the descriptive bulletin CEC-1300-X8.

OSCILLOGRAPH CATALOG — New 16-page Consolidated Recording Oscillograph Catalog available Oct. 1. Write for Bulletin CEC-1500-X8.

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A NEW AIR METER
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Fourth Instrumentation Contest Announcement and Rules

SPONSOR: The Instruments Publishing Co., Inc.

THEME: **"Instruments Cut Costs."**

PRIZES: First Prize, $200; Second Prize, $100; Third Prize, $75; Fourth Prize, $50; three Fifth Prizes of $25 each.

ENTRIES: Each contestant is to submit an original essay, report, dissertation, etc. (hereinafter termed an "entry") bearing upon the Theme of the Contest.

"Instruments." The device or apparatus whose uses are described may be anything from a simple gage to a complete installation of interlocked and coordinated process controllers. Automatic-gaging, automatic-testing, and automatic-inspection set-ups, likewise, are suitable subjects. So are meters. So are electronic devices and many useful "gadgets."

"Report." This type of entry may briefly describe a single case and be written in telegraphic style; or it may present detailed statistics covering a twenty-year period; or it may analyze a whole industry. In this type of entry the data—the numerical "scores"—count more than the style of writing. An entry consisting of charts and tables—with only one paragraph of text—would be acceptable. This "graphic" type of entry is the easier to prepare by entrants who have already gathered statistics or who can gather them.

"Essay" (limit, 1000 words). In this type of entry, the manner of presentation must make up for the possible absence of statistical data; but FACTS must be presented. Wherever exact figures are difficult to obtain, case-studies must be analyzed in sufficient detail to support the conclusions.

"Reports" should not be padded with a number of charts and tables copied from books, journals, etc. available to the public; pertinent abstracts suffice. "Essays" must not exceed one thousand words. Brevity and conciseness will count in grading all entries.

Each contestant may submit as many different entries as he desires.

Entries need not disclose new and patentable instrument ideas: what you are doing with known instruments may be new and widely useful.

Authenticity: Source of data should be given. Manuscripts made up of assertions, figures, charts, etc.—even the most impressive—risk being disqualified if the facts and figures are not supported by references to authentic sources, or are not otherwise verifiable. After the sessions, all manuscripts receiving Prizes or Honorable Mentions will again be checked for accuracy and authenticity before the list of winners is made public.

All "essays," and all textual portions of "reports," must be typewritten, with lines double-spaced or triple-spaced, on one side of the sheet. All charts and other drawings must be in India ink on white paper or clean tracing cloth, suitable for black-and-white reproduction. (No pencil-shaded areas or other treatment that would blur.) Hand-written and single-spaced typewritten essays will not be considered. All entries must be addressed to **Contest Editor, Instruments Publishing Co., 921 Ridge Ave., Pittsburgh 12, Pa.**

The Judges' ratings will be based upon: pertinency of factual data (closeness to the theme); value of information presented (breadth of applicability to problems faced by various industries); timeliness, novelty, originality, etc.; and effectiveness of presentation.

Manuscripts and illustrations become the property of the Sponsor and are not to be returned. The Sponsor reserves the right to publish any article submitted, whether prize-winner or not, and to exercise the privilege of editing each manuscript. Most will be published in *Instruments;* others—especially those of interest to specific industries, in special-scope magazines. Due credit will be given to the author of any article which is published after the selections are made.

Contest closes Saturday, December 31, 1949. All entries must be in the office of The Instruments Publishing Co. on or before that date. Don't forget that the envelopes must be addressed to "Contest Editor."

The articles resulting from this contest will appear in the earliest possible issues of *Instruments;* also some of them will be printed in a number of other periodicals — wherever they will spark-plug the adoption of the latest methods of boosting productivity.

Every reader who knows of one or more ways of using instruments to cut costs is urged to enter the contest. The rules have been made easier than in our previous contests. Brief entries will be examined as carefully as lengthy ones. It isn't as hard as you think! Read the rules and start preparing your entry!

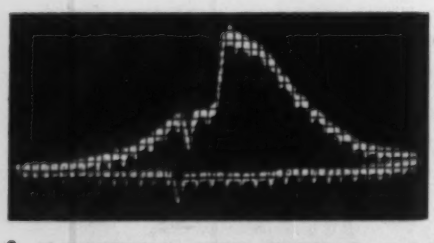


Illustration shows a Diesel engine performance curve. Ignition was about 8 degrees after top dead center. Peak pressure occurred 13 degrees after top dead center, thus angular position of crank is more favorable for efficiently converting pressure thrust into mechanical rotation. Small markers on curve are 5 degree indications, larger markers are top dead center.

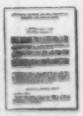
PREVENT OFF-FIRING DAMAGE

maintain a perfect pressure-time curve with the

SYNCRO-MARKER PRESSUREGRAPH

Instantly Shows whether you're firing on top dead center. Off-firing may mean broken piston rings, crankshafts, other damage. The Pressuregraph gives you a full detailed picture of the firing, of pressure variations, both regular and instantaneous. It measures pressure rise with time, accurately and precisely, from vacuum to 14,000 PSI.

The Pressuregraph provides oscillograph pictures which show relation of pressures to engine shaft rotation (top dead center), relation of pressures to time (milliseconds) or indications in degrees of rotation. Also applicable to gas, steam or hydraulic line measurement of static, dynamic or instantaneous pressures. Installation requires only threaded hole in region where pressure is to be checked.



TODAY . . . *Write For Booklet, "Electronic Methods For Measurement Of Pressure and Displacements"* ➔

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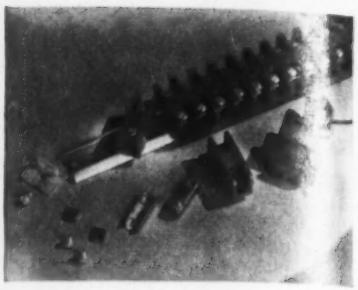
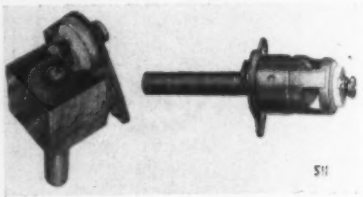


without disconnecting other units. End clamps are available in both a spring type requiring no drilling, and an angle-bracket type held in position by mounting screws. Blocks are available in 25- and 50-ampere sizes, suitable for any voltage up to 600 volts a.c. or d.c.—*Westinghouse Electric Corp., P.O. Box 868, Pittsburgh 30, Penna.*

Mention No. 1066 when filling out card.

Fire Detectors

New CPI Fire Detector is approved and conforms to CAA Technical Service Order C-11, SAE Aeronautical



Sandards Spec. 401 and Navy SR-154A. Feature: positive hermetic sealing by means of an outer can and glass terminal seal.—*Control Products, Inc., 306 Sussex St., Harrison, N. J.*

Mention No. 1067 when filling out card.

Waterproof Switch

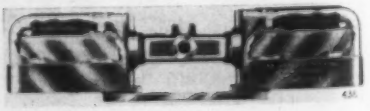
New "Model ES-14" waterproof switch facilitates counting bottles, cans and other round objects. Switch arm is

operated by a 1-inch diameter rubber wheel. Waterproof feature permits installation on bottle and can fillers. Exposed metal working parts are of stainless steel. Speeds to 600 counts per minute.—*Production Instrument Co., 702 W. Jackson Blvd., Chicago 6, Ill.*

Mention No. 1068 when filling out card.

Double-solenoid Valves

New line of double solenoid valves for air pressures of 0 to 125 psi. includes sizes from 0.25 inch to 0.75 inch, available for 110, 220 and 440 volts in both 50-60-cycle and 25-cycle a.c.

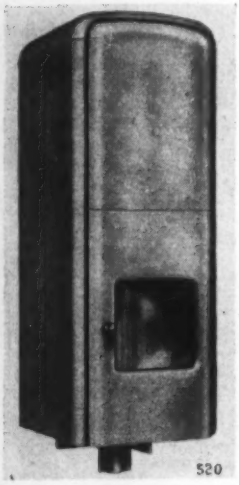


Valve has a one-piece bronze base for each solenoid, powerful solenoids for positive seating and cool operation, heavy sheet metal cover for protection, "OU" type packer and shock-resisting clevis and clevis pin. Models are available in all sizes: 2-way, 3-way piped exhaust, and 4-way piped exhaust. —*Valvair Corp., 454 Morgan Avenue, Akron 11, Ohio.*

Mention No. 1069 when filling out card.

Instrument Housings

New "Gilbarco" standardized metal cabinets for process control instruments, pipe-line instruments, etc., are offered in four different types, with and without windows, for several different



mountings. They are said to be considerably less expensive than individually-built instrument housing of metal or plywood. They are weatherprooof, Bonderized against corrosion, and insulated with foil-covered asbestos. A hinged door permits changing charts or adjusting instruments. For complete accessibility, entire front half of larger cabinets may be removed in a minute's time without use of tools.—*Gilbert & Barker Mfg. Co., West Springfield, Mass.*

Mention No. 1070 when filling out card.

Multiplier Phototube

New "5819" head-on multiplier phototube is intended for use in scintillation counters and detection and measure-

ment of nuclear particle radiation, and in other applications involving low-level large-area light sources. It has high sensitivity to blue-rich light and negligible sensitivity to infrared radia-

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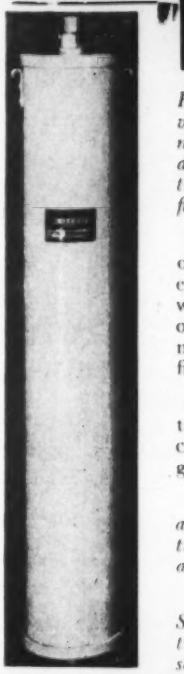

Removes water and oil vapors by cooling. Automatically discharges condensed vapors, filters air through seven layers of finest flannel.

Filter cartridge, made of five concentric, expanded brass baskets, each wrapped with seven layers of canton flannel, furnishes over 15 sq. ft. of filter surface area.

Condensing section contains 68 ft. of 3/8" o.d. copper tubing, providing great heat exchange area.

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Condensing Section

U. S. Patent 2,355,373

Trap Section

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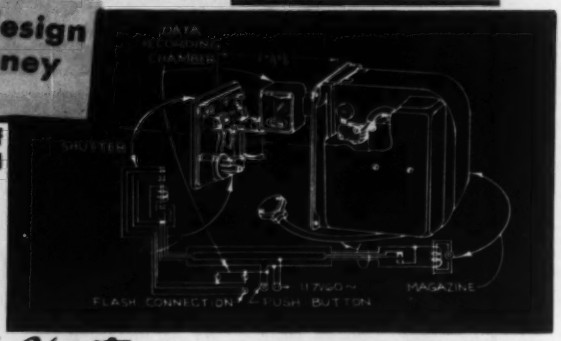

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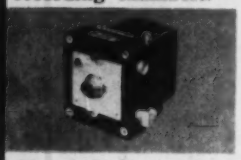
MODEL E—This most versatile model will focus with extreme accuracy—bellows extension 3½" to 9". May be used either vertically or horizontally. It may be equipped with recording chambers.



MODEL D—Designed with fixed focus, this model Varitron is made for oscilloscope, fluoroscope or any operation where conditions of operation remain constant. Lens from 25mm to 12".

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tion. Feature is semi-transparent photocathode which has an area of 1.8 square inches, permitting efficient collection of light from large-area light sources. Spectral sensitivity characteristic peaks at about 4800 Angstroms and cuts off at about 3100 and 6500 Angstroms, a region in which many organic and inorganic phosphors respond efficiently to radioactive emanations. Utilizing 10 electrostatically focused dynode stages, "5819" operated at 90 volts per stage is capable of multiplying treble currents produced at cathode under weak illumination by an average value of 400,000 times.—*Tube Dep't, Radio Corporation of America, Harrison, N. J.*

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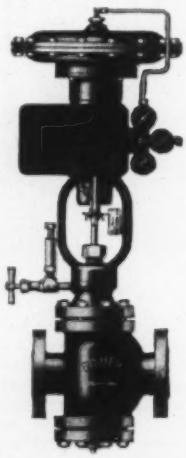
Control-valve Positioner

New "Series 3500" valve controller ("Positrol") is for automatic-control applications where control valve does not position itself according to commands of control instrument. In such



instances "Positrol" insures correct position of valve. It is of force-balance type, simple in design, consisting of a few levers, a bellows unit and a spring. Valve travel is easily adjustable between 0.25 in. and 3 in. "Positrol" is available with or without by-pass and may be used as a remote position indicator.—*Fisher Governor Co., Marshalltown, Iowa.*

Mention No. 1072 when filling out card.

Soldering Pencil-iron

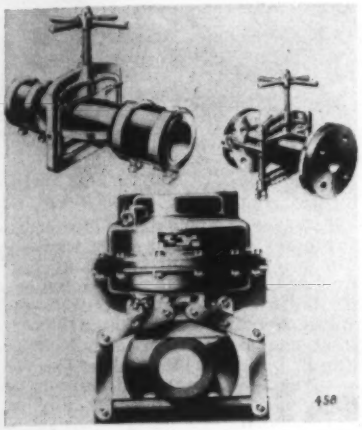
New "No. 61" pencil iron is 7 in. in length, weighs 2.5 ounces exclusive of cord. Handle temperature, at point where held in fingers, is no higher than

body temperature. Element construction is identical to that used in maker's industrial irons. Tip is so-called plug type, held in place with a set screw. Three shapes of tips are available: pyramid point; straight pencil point; and bent 90 degrees with a pencil point. Iron is regularly wound to 25 watts at 105-120 volts, but, when required in quantities, may be had in higher wattages at no extra cost.—*Electric Soldering Iron Co., Inc., Deep River, Conn.*

Mention No. 1073 when filling out card.

Control Valves

Three new lines of "Flex-Valves" are announced: (1) Slip-on "Type 7100" in sizes 0.5 to 2.5 in. which



mounts over ends of pipe; (2) Flanged-end "Type 7200" in sizes 1 to 12 in.; (3) Diaphragm-motor type in sizes 1 to 10 in., available in Air-to-open and Air-to-close operations. Valves are said to be practically indestructible on abrasives or corrosives not affecting rubber, neoprene, Buna N and butyl. Among features: no internal parts or obstructions, freedom from water hammer, 11 to 1 life on abrasives over steel, non-clogging service, full pipe capacity, absolute bubble-tightness. — *Flexible Valve Corp., Palisades Park, N. J.*

Mention No. 1074 when filling out card.

Refrigerated Bath

New Refrigerated Bath for laboratory use obviates need for makeshift arrangements and use of ice in cooling

reaction vessels with their contents; is of particular usefulness in metallurgical laboratories for cooling volumetric test samples, in water and sewage laboratories, and wherever exothermic re-

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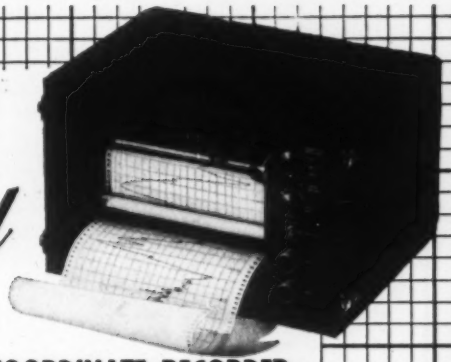

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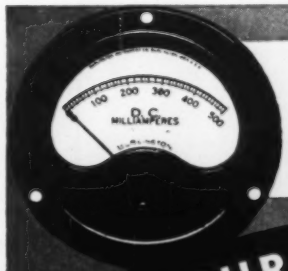

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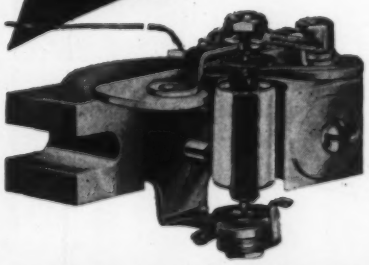

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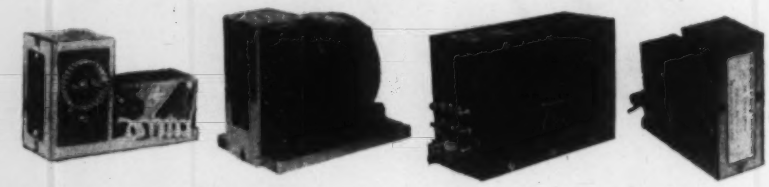

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actions are under study. Bath is a copper-lined steel cabinet with tray adjustable by means of supporting chains over height of 10 in. Thermostat provides low temperatures which can be maintained for 15 to 50 gallons of water at any point from 0 C. to room temperature. Interior is about 37 in. long by 21 in. wide and 15 in. deep. Cover, hinged at middle, rests on rubber insulation. Bath operates on 110-volt 60-cycle a.c.—*Fisher Scientific Co., 717 Forbes St., Pittsburgh 19, Penna.*

Mention No. 1075 when filling out card.

Splash-proof Precision Switch

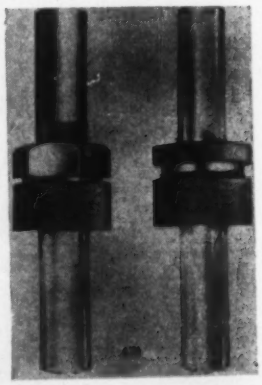
New "OP-AR 50" heavy-duty precision switch with "plate" type actuator, designed for locations subject to splash

of oil, water, and coolant, is especially advantageous on equipment where operator safety demands two-hand control switches. Housing has a gasketed cover plate and a closely fitted actuator shaft through housing wall which serve to protect enclosed switch unit. Electrical rating is 15 amps, 125, 250, or 460 volts, a.c. Circuit arrangement is s-p. d-t. —*Micro Switch, Spring St., Freeport, Ill.*

Mention No. 1076 when filling out card.

Glass-pipe Coupling

New threaded metal coupling, for use with Pyrex glass pipe lines, simplifies installation of glass piping by replac-



ing three-bolt triangular metal flanges. Use of wrenches is no longer necessary; perfect alignment is assured; danger of breakage due to uneven take-up is eliminated; installation time is minimized. Metal couplings are available from stock in sizes 0.25, 0.50, 0.75 and 1.00 inch for making glass-to-glass or glass-to-metal connections.—*Fischer & Porter Co., Hatboro, Penna.*

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Lever-action Switch

New "Lev-R" small lever action switch offers many features of telephone type switch, is especially adaptable for use on low-power switching applications such as test equipment, signal systems, etc. It is claimed to be

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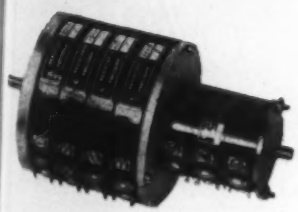

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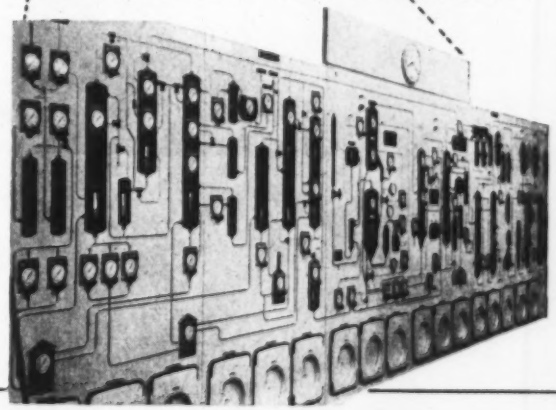

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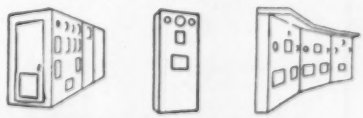

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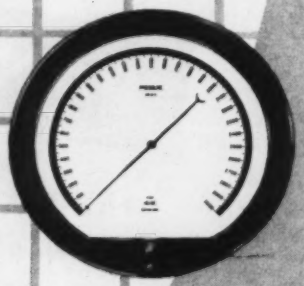

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Three sizes: 8½ in., 12 in., and 16 in., in ranges from 0-15 to 0-10,000 psi. Prices from $151.60 to $211.20. Write for catalog.

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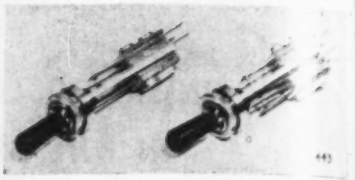

an ideal inter-communication talk-listen' switch, unique for its size, simplicity and beauty of design. It is furnished in standard circuits, in both two- and three-position actuators, either type locking or non-locking. Mounting hardware is nickel-plated brass, and black plastic knob is removable. Overall length 3.267 in.; width 0.625 in.; height depends on circuit.—*Switchcraft, Inc., 1328 N. Halsted St., Chicago 22, Ill.*

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Blow Torch

New "Besjet" is a featherweight pocket size automatic blow torch weighing 10 oz. and measuring 7.25 in. tall

said to perform with efficiency of a standard size blow torch. Completely automatic, and operating with denatured alcohol as fuel, it requires no priming or pumping, gives a six-inch flame of 1800 F. in 10 seconds, operates approximately one and one-half hours. —*Emil Greiner Co., 20-26 North Moore Street, New York City.*

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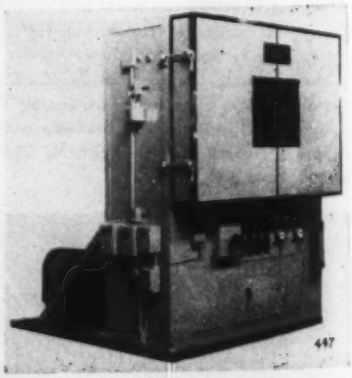
Refrigerated Chamber

New refrigeration unit is completely valved so that any part of system can be by-passed during testing operations. Three different types of low-side evap-



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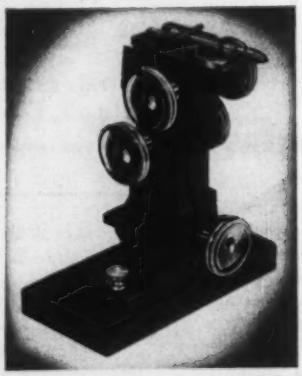

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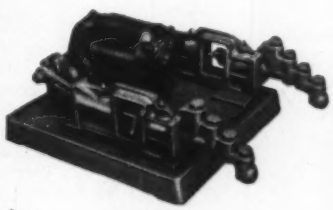
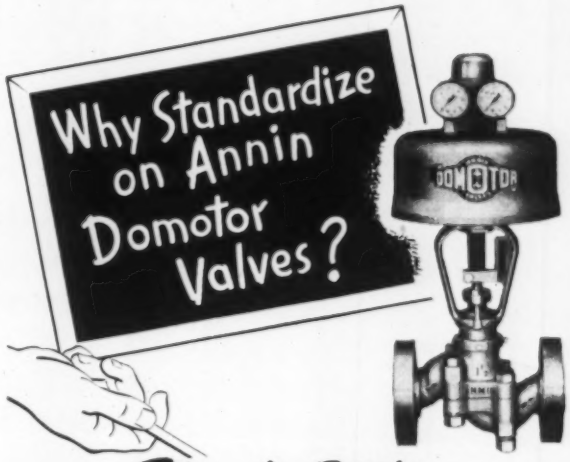
Select Milton Roy Pumps for the above applications . . . pumps that are non-clogging and self-cleaning . . . positive displacement, precise metering units that handle everything from slurries and solids in suspension to the lightest solvents, hot or cold . . . pumps with liquid ends to meet practically every corrosion resistant problem and to pump up to 20 thousand psi for high pressure catalysis and hydrostatic testing.



Investigate. Ask for Catalog 146.

MILTON Roy COMPANY
1309 E. MERMAID AVE., CHESTNUT HILL, PHILA. 18, PA.

Why Standardize on Annin Domotor Valves?



Here's Why...

THEY'RE SINGLE SEATED. Annin Domotor Valves are of simple, single seat design. The valve seat, clamped in position between the two sections of the separable valve body, absorbs all line stresses in shear. There are no troublesome threads to cause distortion and leakage. No grinding-in operation is necessary. The smooth, curved contour of the flow passages reduces turbulence and pressure drop to a minimum, and provides greater flow capacity. Slurries, sludges and viscous fluids are effectively controlled through the elimination of pockets and shoulders that ordinarily accumulate solids.

THEY'RE EFFICIENT. Field proven, piston-type, Annin Domotor Valves provide smooth, positive control, accurate to .0005 in pressure impulse response. They will handle high velocity fluids at temperatures from −300°F to 1000°F and pressures to 2500 lbs. Simplified construction cuts valve body weight by over 50%. Down-time for maintenance is reduced to an absolute minimum.

THEY'RE VERSATILE. Annin Single Seat Domotor Valves have interchangeable line flanges. A single valve may be used anywhere in your plant regardless of system pressure. With the valve seat serving as a pivot, the two-piece valve body may be rotated in assembly to form a right-hand angle, left-hand angle or straight through pattern. The addition of a simple adapter provides an angle pattern valve. The separable valve construction provides fast, on-the-job inspection or replacement of the valve trim.

THEY'RE AVAILABLE IN A WIDE RANGE OF ALLOYS. Annin Single Seat Domotor Valves are offered in a wide range of alloys for effective control of corrosive, erosive or gaseous fluids under the most severe operating conditions. They are available in Cast Carbon Steel, Cast Type 316 Stainless, Annico 20 (D 20), Hasteloy B and C, Monel, Ampco 15, 98% "A" Nickel, Zinc Free Bronze and almost any castable alloy.

Write today for this bulletin.
A new bulletin showing installation and operating features of the Domotor Valve will be sent to you upon request.

THE ANNIN COMPANY
3500 Union Pacific Avenue
Los Angeles 23, California

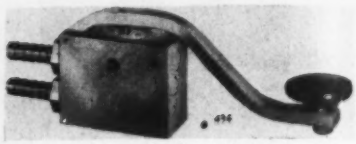
Investigate ANNIN DOMOTOR VALVES *Valves*

orators are completely interchangeable: a plate coil, a bare tube coil, and a finned tube coil. Thermostatic expansion valves are located inside cabinet and on outside, either or both can be used or both may be cut out of system through a by-pass arrangement. A thermostatic expansion valve is also used on sub-cooler. A manual control is provided for use when thermostatic valves are cut out of system.—*Tenney Engineering Co., 26 Ave. B., Newark 5, N. J.*

Mention No. 1080 when filling out card.

Three-way Air Valves

New three-way air valves provide an "ON" or normally-open companion to "OFF" models announced last year.



"FT-102" valve has 0.375-in. pipe thread apertures for quick response when used with air cylinders up to 6-in. bore, and operates by a light touch on handle-lever button. "FC-102" is the same valve without lever, for operation by means of cam or trigger on working machine. Both new models have mounting holes at top and sides to facilitate attachment to any machine; are of poppet type without sliding closures.—*Mead Specialties Co., Dept. V-37, 4114 No. Knox Ave., Chicago 41, Ill.*

Mention No. 1081 when filling out card.

Mercury Cleaning Equipment

New "Bethlehem Mercury Oxifier" cleans metal-contaminated mercury for re-use through a new method. It is said that even badly fouled mercury can be transformed in several hours into a product suitable for use in manometers, McLeod gages. Process requires little

attention, costs no more than electric power consumed by motor. Apparatus consists essentially of a glass drum into which mercury is poured, with an agitator, electric motor, and receptacle to hold clean mercury. Process utilizes principle that base-metal contaminations oxidize and precipitate from mercury as metallic oxide powders. Agitator beats mercury into a thick spray to maximize air contact with mercury droplets, so that any metals which oxidize and form skins will, on prolonged air contact, produce all the skins they can possibly form. As these skins are continually broken up, nothing is left

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find leaks quickly

With G-E leak detectors you can easily locate even the smallest leaks in closed systems. Detectors are ideal for locating leaks in installed equipment or in the products you make.

Use the Type H detector for pressure systems, the Type M for evacuated systems.* Write for Bulletin GEC-233 (Type H) or for GEC-336 (Type M). Address *Apparatus Dept., G687-21, General Electric Co., Schenectady 5, New York.*

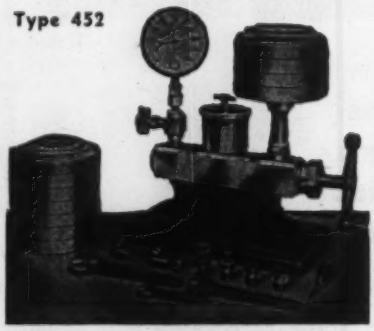
**If the system is filled with combustible gas, write for special application information.*

GENERAL ELECTRIC

GEC-21

AMTHOR Dead Weight Pressure Gauge TESTER

Type 452



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Here's simplified, automatic sequence control for a series of three or more related machine or process operations. Custom built and assembled from standard parts to your sequence, duration and frequency control requirements. Total time cycle and "make and break" periods adjusted easily. Controls accurately as many as 10 or more load circuits . . . as few as two. Install it on new or present equipment.

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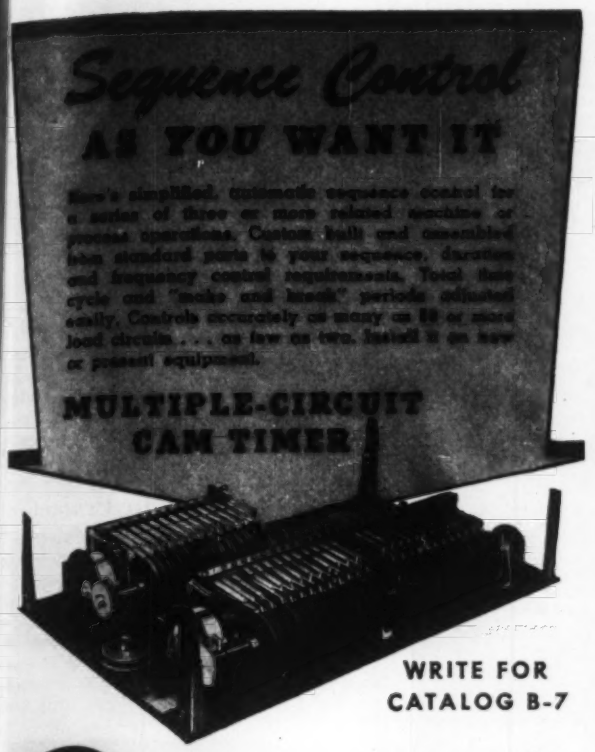

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TIMERS: STANDARD LINE AND SPECIAL

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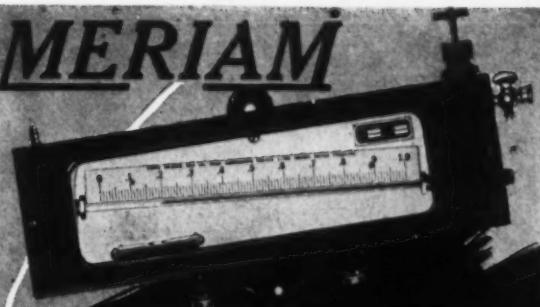

DRAFT GAUGE
for Quick, Accurate Measurement of LOW PRESSURES and DRAFTS

THIS handy gauge is widely used for measuring low pressures, drafts and differentials—such as furnace drafts, pressure drop across filters, and velocity pressures; also pressure drop across displacement meters and pressure measurement on bell provers.

It is a direct reading instrument with an inclined tube giving increased scale length to permit accurate readings of fractional inches of water pressure.

Housing is of dull black crackle with bracket for wall mounting, having two adjusting screws for leveling. Each gauge is individually calibrated, insuring extremely accurate operation.

Available in Single-Tube, Two-Tube and Three-Tube styles. Sturdily built for long, carefree service. Each gauge is furnished with standard accessories ready for operation. Write for Bulletin 4.

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1. You get permanent accuracy because the resistance wire is locked in place. It is precision positioned and moulded integrally with the housing.
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but powdery oxide, readily separable from the clean mercury beneath. After being agitated, mercury is transferred to a receptacle where it is held for sufficient time to allow all oxide particles to rise to surface; then after filtering, it is ready for use. When physical dusts, oils, or greases adhere to the surface, the new "Type F" "gold adhesion" filter removes them in a few minutes. After treatment, mercury is suitable for use in precision instruments. Apparatus handles batches up to 25 pounds at one time with a residual contamination of less than one part per million. It is 17½ inches high, weighs 61 pounds, operates on 115-volt 60-cycle a.c.—*Bethlehem Apparatus Co., Front & Depot Sts., Hellertown, Pa.*

Mention No. 1082 when filling out card.

Miniature Contour Projector

New Miniature Contour Projector is designed to provide all industry with the advantages of optical projection in a shape best suited for bench and bed inspection operations. Modifications of standard unit for special purposes can be made with a minimum of expense and inconvenience. Feature is a totally enclosed screen which allows unit to be

used anywhere without interference from surrounding lighting conditions. Standard magnifications are 120, 90, 60, 45 and 30. (Values above, below and in between the standards are available but special.) Standard screen size is 6 in. square and field of view at any magnification may be calculated by dividing magnification value into 6 in. Standard projector is equipped with one blank opaque screen, light source and lamp house, complete optical system for one standard magnification, and operates on 115-volt 60-cycle a.c. Other power ratings available. Standard staging fixtures and gaging fixtures for specific duty are available.—*Stocker & Yale, Marblehead, Mass.*

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Wide-band Chain Amplifier

New "Model 204 Wide-Band Chain Amplifier" is aperiodic, uses a traveling-wave circuit—a new principle of amplification; has unusual specifications of a band width of 200 Mc. and a gain of 40 db. With an impedance of 200 ohms, and a nominal transmission characteristic of plus-or-minus 1.5 db from 100 kc. to 200 Mc., amplifier has a substantially linear phase shift; also an exceptionally fast rise time, 0.003 microsecond; therefore is suited for use

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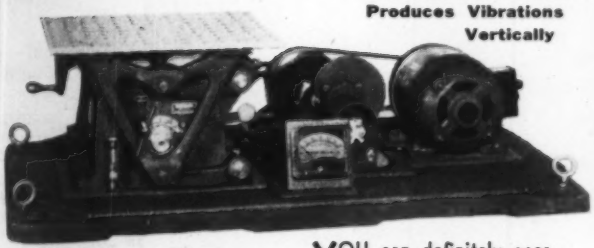

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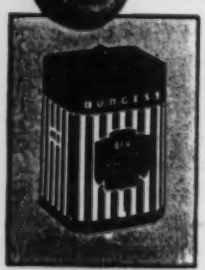

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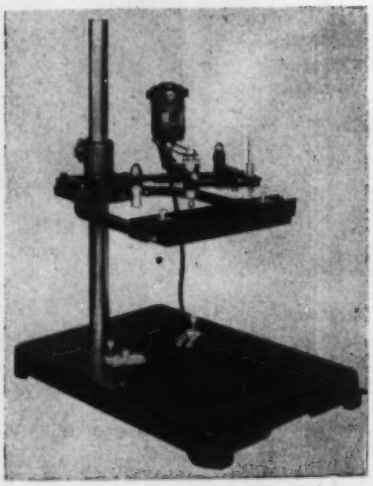

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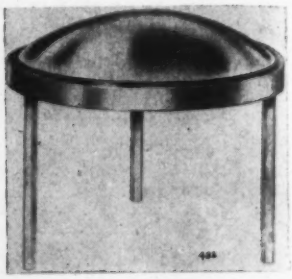
Desk or Bench Magnifier

New "Magniprox," a desk magnifier with anti-fatigue features, is mounted in a tripod case which rests on desk and



allows freedom of hands, has a 4.5-inch plano-convex lens, permits use of both eyes, imparting a three-dimensional quality to small objects under observation. Having no fixed working distance, magnifying lens can be used from either a standing or a sitting position. Magnification is between 1.5 to 2.5 diameters.—*Buhl Optical Co., 1009 Beech Ave., Pittsburgh, 12, Pa.*

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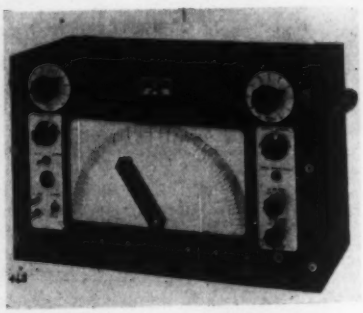
Audio Sweep Generator

New Automatic Audio Sweep Generator has a frequency of 25 to 32,000 cps. in one continuous range, within



which the automatic sweep may be adjusted to any spread from 500 to 10,000 cps., or instrument may be operated manually. Wave-form distortion is stated to be less than 0.5 percent and sweep calibration is linear, sweep frequency being adjustable from 2 to 10 sweeps per second. Panel calibration is direct with "Verni-Vicer" dial approx. 17 inches in length.—*Clough Brengle Co., 6014 Broadway, Chicago 40, Ill.*

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A plain everyday cotton swab is all that is required for applying Cerroseal-35 in hermetically sealing glass to glass, glass to metal, etc.

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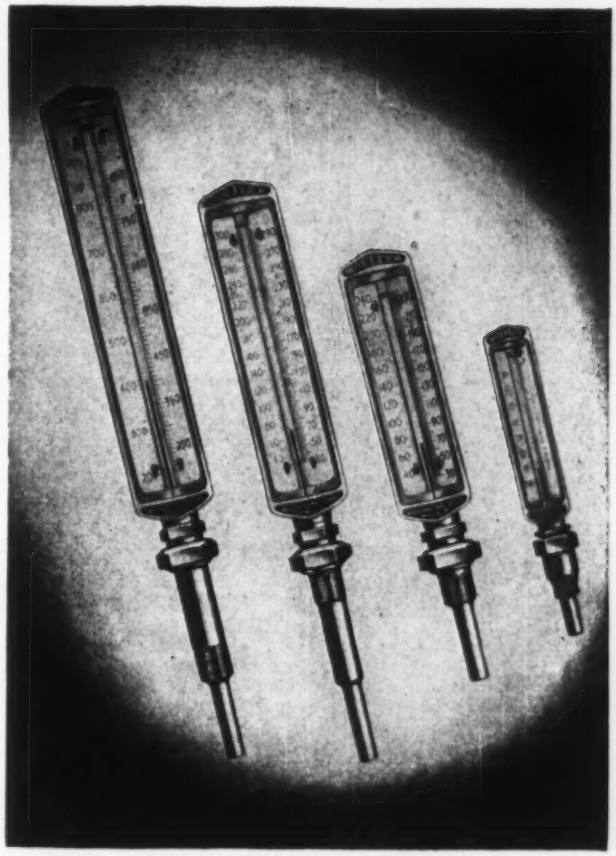

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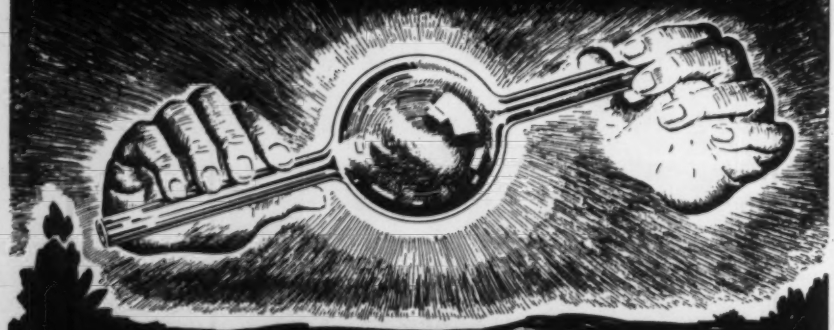

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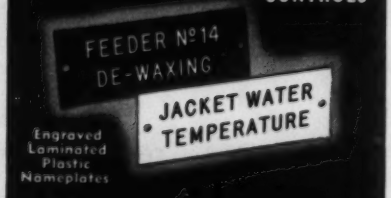

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TECHNICAL SOCIETIES

Society for Applied Spectroscopy

The November meeting of the Society for Applied Spectroscopy will be held on Tuesday, the 1st at 8:00 p.m. at the Socony-Vacuum Training Center, 63 Park Row, New York. Speaker, Mr. William L. Dutton, American Cyanamid Co., subject, Semi Quantitative Analysis for Metals by Emission Spectroscopy.

The December meeting of the Society for Applied Spectroscopy will be held on Tuesday the 6th at 8:00 p.m. at the Socony-Vacuum Training Center, 63 Park Row, New York, N. Y. Technical Chairman, Dr. Nelson Trenner, Merck & Co., Inc.; speaker, Prof. Ralph S. Halford, Columbia University; subject, Polarized Infrared Spectra. —RODGER W. LOOFBOUROW.

Diffraction Conference

As announced in our last issue, the Seventh Annual Pittsburgh Diffraction Conference will be held Monday and Tuesday, Nov. 7 and 8 at Mellon Institute, Pittsburgh, Pa.

FINAL DETAIL—Those planning to attend are asked to notify Registration Chairman Russell W. Turner, Metals Research Lab., Carnegie Institute of Technology, Pittsburgh 13. State number of persons in party, also number who will attend the dinner Monday evening. For other information write or wire to Program Chairman R. K. Scott, Hall Labs, 323 Fourth Ave., Pittsburgh 22.

Symposium on Air Pollution

LOS ANGELES, Calif.—Nation-wide scientific activity in the field of air pollution has grown to such magnitude that a National Symposium on Air Pollution, presented by Stanford Research Institute in cooperation with the California Institute of Technology, the University of California and the University of Southern California will be held at the Huntington Hotel in Pasadena on November 10 and 11.

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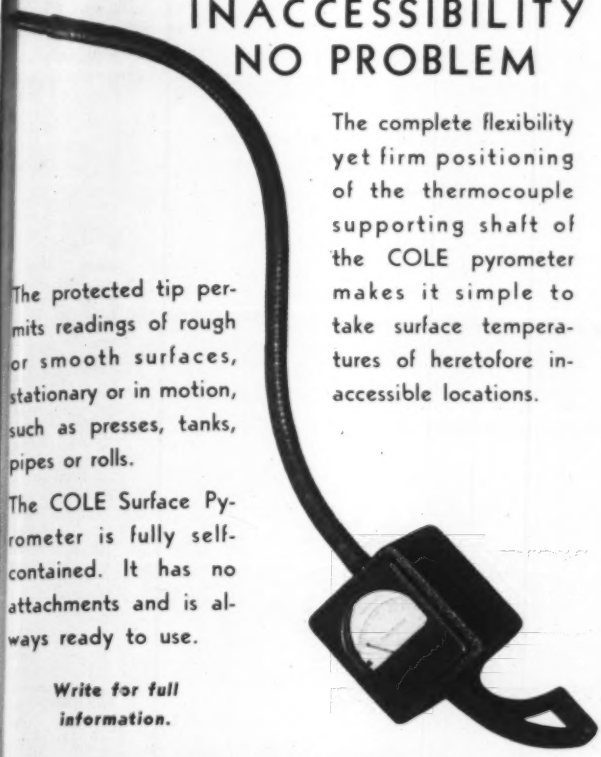

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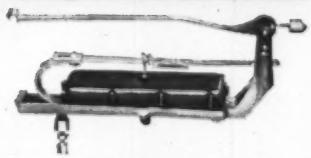

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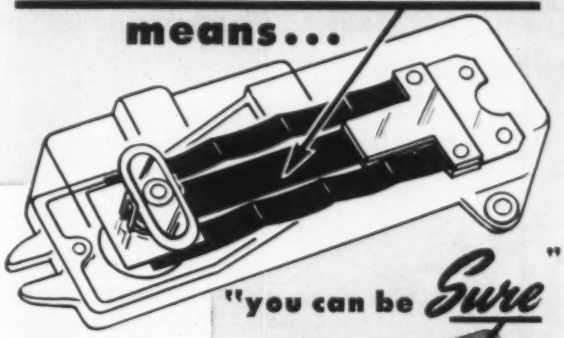

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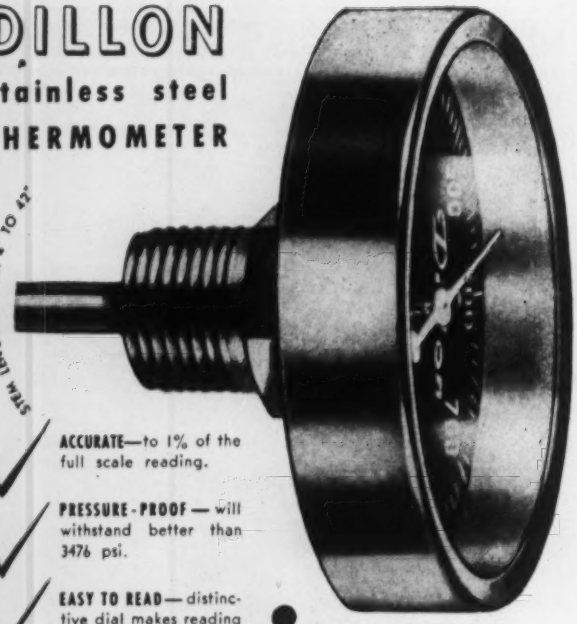

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Continued from page 911

For example, in air conditioning it has been found beneficial to split incoming air into two streams, one of which is over-humidified for subsequent blending with the untreated stream, to obtain closer regulation.

The same principle has been applied successfully to pH control by the writer on a number of occasions. This principle

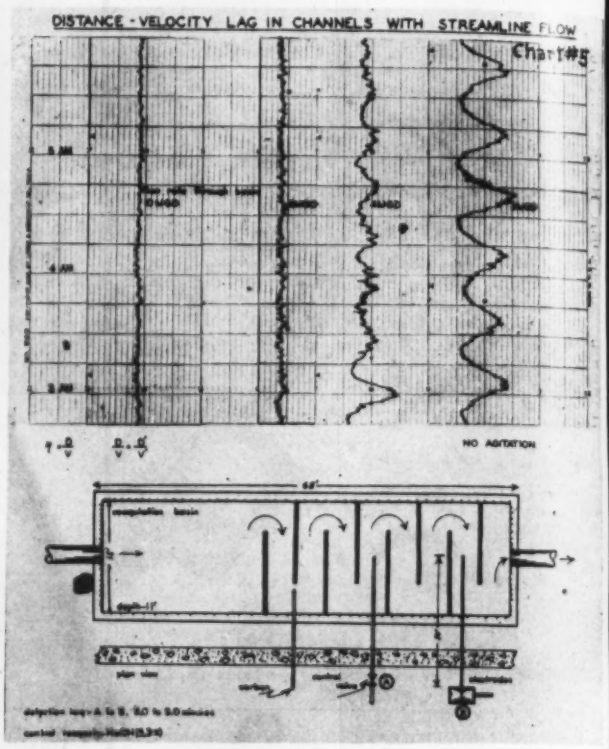

Fig. 61. Illustrating effect of distance-velocity lag in process unit pH control.

is particularly useful in handling strong concentrated reagents which normally require sharp precise valve action not ordinarily obtainable with single-valve control installations.

Fig. 62 is a typical application of this split-flow principle to a process wherein concentrated sulphuric acid is used to adjust pH of a process stream. Flowmeter FCR-1 regulates flow of treated liquors to the following process unit. A portion of the untreated stream is diverted to an intermediate control tank by LLC-1, where concentrated acid is added by

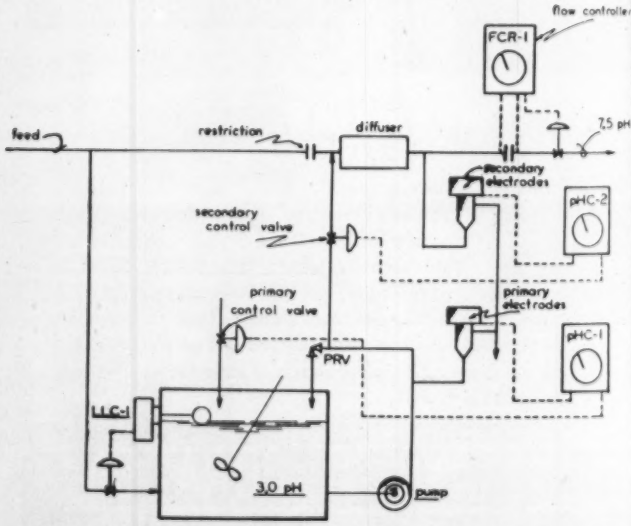

Fig. 62. Application of "split-flow" technique to pH regulation of chemical process.

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pHC-1 to adjust intermediate pH to approximately 3.0. A second pH controller, pHC-2, regulates feed of the intermediate liquor to a diffuser where it blends with untreated liquor to adjust final pH to 7.5.

Essentially, this process differs little from conventional practice wherein reagent is diluted to a fixed concentration in a separate storage tank and fed to the process by a single regulator which, in this case, would be pHC-2. However, some advantages do derive from the method since it is essentially a two-stage system, and over-all residence volume can be reduced below the requirements for a single-residence process. It may also, in some cases, offer a savings in piping and equipment required for reagent storage and handling in a conventional layout. Reagent supply for the illustrated process consists of parallel-connected carboys mounted in a rack above the control tank and pressurized slightly with air to deliver reagent to the control valve.

The pH regulators are of the electronic proportional-position air-operated type—preferred because of inherently fast valve action. The diffuser in this case is nothing more than a low-volume tank equipped with baffles and loose packing but its use may be limited in other applications by the presence of equilibrium lag or slow-acting regulators and large load swings which may require larger retention at this point. Ordinarily, one would expect the best results to derive from proportional-position pH regulators under such conditions, when instrument lags are at a minimum and the reaction fast in response to load changes of a process having a low reaction period. If the period of the process is high and response of the regulator is delayed, one might expect advantages to result from the use of derivative regulators.

No fixed rule can be established for the use of the system described above since its dimensions depend on individual process conditions. One principal limitation, however, is the requirement for a special small-capacity primary control valve: The one illustrated was fabricated from laboratory glassware, but commercial valves have since made their appearance on the market and should find wide application in general pH control problems.

(B)

Fig. 63 is a unique application of the split-flow principle to the successful regulation of a difficult and perplexing control job. The object of pH control here was to remove dis-

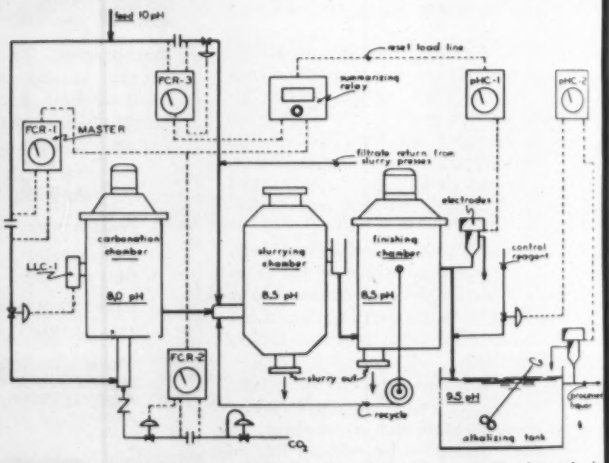

Fig. 63. Application of "split-flow" technique to avoid electrode incrustation in difficult pH control process.

solved calcium from solution and subsequently realkalized with sodium carbonate to facilitate recovery of an organic product.

Solubility of calcium in solution follows a very sharp relationship to pH, as indicated in Fig. 64, and requires precise regulation at 8.5 pH to obtain maximum precipitation. It was not possible to apply electrodes directly to the slurrying vessel because of calcium incrustation which covered them within a short time and desensitized the regulator: A multi-stage process with cascaded regulation became necessary.

The influx feed is divided into two streams, one regulated by LLC-1 and the other by FCR-3. Flow of the main stream

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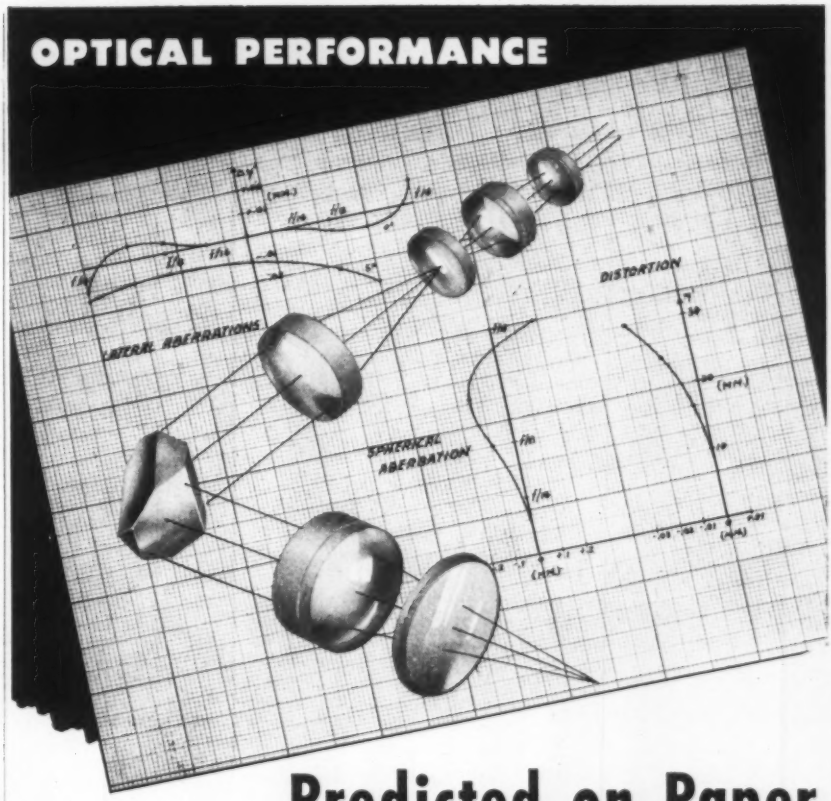

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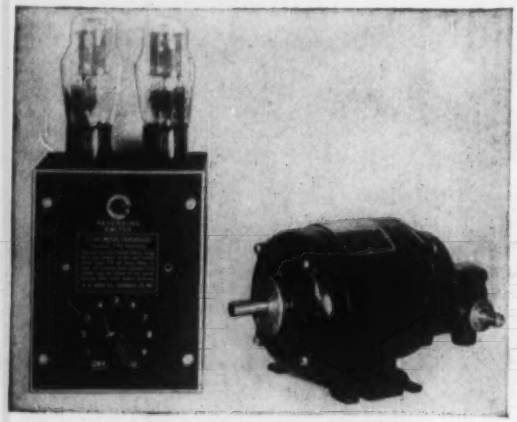

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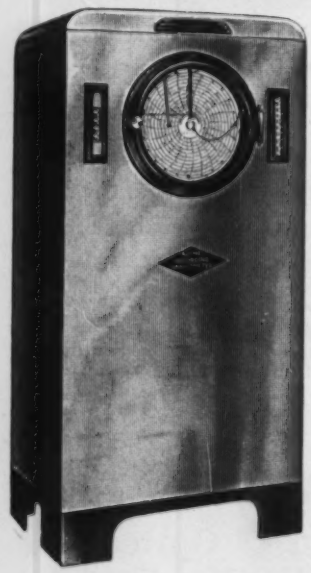

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is measured by FCR-1 which adjusts the set point of FCR-2 to regulate CO_2 input as a function of main liquor flow. This ratio is set to overcarbonate to about 8.0 pH in the first carbonation chamber. FCR-3 is ratio-flow set by FCR-2 to feed uncarbonated liquor to the second stage slurrying tank where it blends with overcarbonated liquor in exact ratio to increase pH to the critical point of precipitation, namely 8.5 pH. Slurry settles and is withdrawn at the bottom while

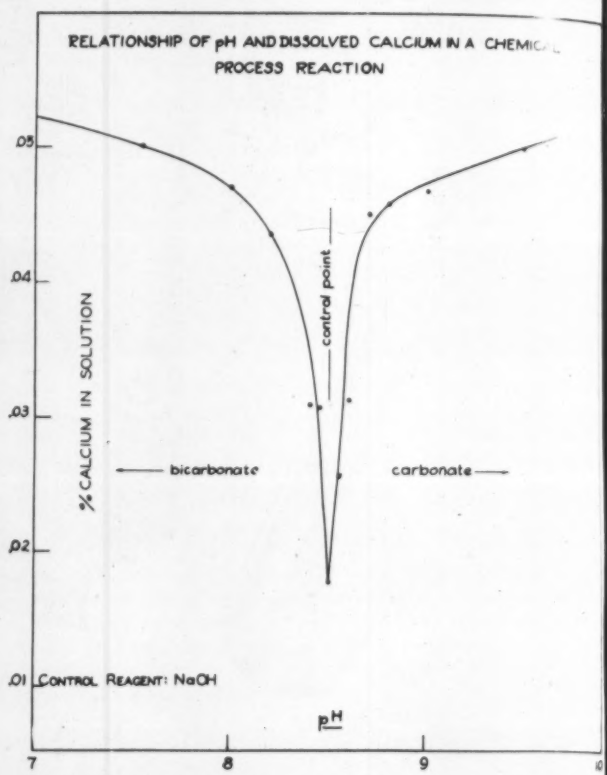

Fig. 64. Effect of pH on solubility of calcium ions in chemical process described in Fig. 63.

clear liquor is decanted and fed to a finishing chamber for final settling. A portion of the finished liquor is recycled to the slurrying tank to provide buffering action.

One pH controller, pHC-1, measures effluent pH and adjusts ratio of FCR-1 and FCR-3 to maintain 8.5 pH at the discharge; a second pH controller, pHC-2, realkalizes the finished liquor to 9.5 pH for subsequent processing.

No unusual precautions were necessary in the operation of this process beyond the necessity for periodic cleaning of the slurrying chamber with dilute HCl. Electrode maintenance was not unusual, beyond a daily schedule of rotating them with spares, more as a precaution against high temperature operation rather than incrustation—which collected only as a thin film in twelve hours' operation.

The carbonate reaction has inherent buffering characteristics on the bicarbonate side, and buffer index and load variations of the mother liquor was low and constant, thus presenting no major limitations. It is apparent from Fig. 64 that load must be fairly uniform if precise deliming is to be achieved. This characteristic is critically sharp and necessitates reaction uniformity.

To be continued

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JOURNAL of the
Instrument Society of America

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Vol. 5 OCTOBER 1949 No. 10

President's Report to the Board of Directors

To the Board of Directors of ISA:

St. Louis—1949, Philadelphia—1948, Chicago—1947, Pittsburgh—1946; these are the landmarks in the bright, though brief, history of the Instrument Society of America. From an initial membership of approximately 1000, and some fifteen sections, the Society in the short space of four years has increased in strength to approximately 4000 members, distributed over about fifty sections.

This growth of membership and section roster to the present level, with the attendant high level of its technical activities, has given ISA a very mature status in the world of technical societies. Its membership list compares well with that of other organizations ten times its age; its record of achievement is one worthy of the pride of its members. Nevertheless, in spite of this justifiable feeling of pride in the Society's accomplishment, we are all mindful of the continued need to adjust the structural basis of the Society, as well as its program of activities, to coincide with the clearer pattern that develops with the achievement of maturity. This is generally true of young organizations, and especially true of ISA. Accordingly, the past two years, particularly, have been devoted not only to a stimulation but also to a clarification of activities, streamlining of organization, and re-evaluation of the goals toward which we are progressing.

Last year, under the presidency of Paul G. Exline and with the support of a vigorous Executive Committee, the arrangement of the ISA structure into three important divisions, each under the administrative supervision of a vice-president, was initiated. These were the (a) Membership Relations Division, (b) Operating Division, and (c) Technical Division. Their setup has represented a marked improvement in the functional structure of the Society. Under these administrative divisions, headed this year by vice-presidents J. B. McMahon, F. H. Trapnell, and A. O. Beckman, respectively, the work of the Society has gone forward with a very active stimulus. The different Standing Committees of the Society, headed by a splendid group of persevering chairmen, have functioned within the structure of the above-cited Divisions. Special committees, other than Standing Committees just noted, are assigned to the supervision of the First Vice-president. They comprise the Committee on Exhibit Policy on Abstracting Service, and on Society Structure and Planning, and have in the past year been under the administrative supervision of First Vice-president Frost.

Your Executive Committee has been composed of your President; Vice-presidents H. C. Frost, J. B. McMahon, F. H. Trapnell, and A. O. Beckman; Secretary Richard Rimbach, Treasurer H. E. Ferguson, L. H. Allen, Jr., H. H. Barnum, and Past-president P. G. Exline. This administrative committee, whose work your President is privileged to report, has truly been an able, diligent, and most cooperative group. It has held five meetings during the year in different locations of the country, with a formal quorum in attendance each time, despite the many miles its members have had to travel, be it noted, at their own expense; Philadelphia, September 16; New York, December 1 and 2; Chicago, March 6; Toronto, May 13; and Pittsburgh, July 16 and 17. In addition to these scheduled meetings, there has been extensive communication, by mail and telephone, between the members of the Executive Committee throughout the entire period, to carry on the interim affairs.

Annual Business Meeting of Society

Specifically to be called to the attention of the Board of Directors, as well as of the membership at large, is the scheduled Business Meeting of the Society on Monday, September 12, at which the membership will have an opportunity to meet the Officers and the members of the Board of Directors, and at which different committee reports will be presented.

Society Activities

The different Standing Committees, headed by a splendid group of chairmen and comprising actively interested personnel, have carried on with creditable result. Their work has been reported on so fully at the Semi-annual meeting in Toronto and their reports included in the Minutes of that meeting, that they need not be reported on in detail in this report. Specifically to be noted is the achievement of the Technical Division, as reflected in the program of technical papers included at this year's Conference; the composite program has of course been put together by the Meetings Committee, with E. R. Grace, Chairman.

It should be emphasized at this point that continuity in Committee setup is extremely desirable so that our activities do not lose their momentum in the transition from one year's regime to another.

At the Annual Business Meeting of the Society on Septemmber 12, noted above, a summary of different committee activities under their supervision will be presented by each of the Vice-presidents, and the Minutes of that meeting will further constitute a permanent record of the year's progress.

It is of particular interest to discuss some of the special items that have occupied the attention of the Executive

New Officers

R. J. S. Pigott, Chief Engineer, Gulf Research and Development Company, was elected President of the Instrument Society of America at the meeting of the Board of Directors of the Society, on September 10th.

Pigott is responsible for a number of widely-known developments, such as the marsh buggy for geophysical explorations, a new device for measuring wall pressure of piston rings, and the effect of air in oil on altitude sealing of airplanes. Mr. Pigott has wide experience in several industries: rebuilt both plants of N. Y. Interboro Rapid Transit and electric power plants in east and middle west; Pressure Steam Engineer, Columbia University; in charge of power, Remington Arms; Superintendent, Bridgeport Brass; Works Manager, Crosby Steam Gage and Valve; Chief Engineer, Stevens and Wood, and Public Service Production Company of New Jersey.

Pigott was Chairman of the ASME Special Research Committee on Fluid Meters (1916-46); Member Main Power Test Codes Committee (1918-1946); Vice-President, ASME (1938); President SAE (1949); President, American Society for Measurement and Control (1941-45) and Chairman of Pittsburgh Meeting on April 28, 1945 at which the organization of the Instrument Society was consummated.

The Board of Directors also elected two new Vice Presidents to the offices left vacant by the retiring Vice Presidents H. C. Frost and F. H. Trapnell. Mr. Nelson Gildersleeve, 1948 and '49 Sections and Membership Committee Chairman, will supervise Section and Membership Relations. Gildersleeve is with the General Electric Company at West Lynn, Massachusetts, and is a member of the Boston Section ISA.

Mr. Porter Hart, well known for his active work in the Society, Chairman of the Instrumentation for Production Processes Committee and prominent member of the Houston Section, was elected as Vice President supervising the Operating Division.

Vice-President J. B. McMahon was elected First Vice President.

St. Louis River Excursion

The river excursion on the S. S. Admiral, held on the Wednesday evening of Show week, was attended by over 1200 members and guests. Following the short formal program which included the introduction of Society officers, the presentation of charters to new ISA Sections and a talk by a local humorist, members and guests enjoyed themselves on the spacious dance floor of the Admiral. Drawings for free prizes during the orchestral intervals provided special entertainment.

Committee during the year of ISA activity. Because of their nature, some of these items are covered in fuller detail than others.

Budget

One particular item that prominently affects the operation of every organization is that of Finances, involving both the elements of Accounting and Budgeting. Development here has been carried forward toward a very desirable goal: an improved system of accounting is now being installed under the direction of a qualified accountant so that at all times the Society's financial condition may readily be ascertained. The corollary process of budgeting by the Finance Committee may thus take place with full knowledge of the actual year's expenditures as compared with the previously authorized budget provisions. The Society is fortunate in having a very able Finance Committee, under the chairmanship of George R. Feeley. The 1950 Budget, included in this Report as Appendix A, is to be studied with interest. Though our financial condition is relatively satisfactory now, still however, it is essential to consider it from the long-range viewpoint. Thus this constitutes one of the problems to be considered by the Society Structure and Planning Committee.

Revision of the Constitution

The Constitution Committee has been headed by Earl C. Rieger as chairman. For more than a year, this Committee has labored assiduously on the details of this all-important document so as to clarify and coordinate its provisions, and to revise it in accordance with the goals of the Society. The Committee has done an excellent and painstaking job, completing each assignment expeditiously. Continuous discussions have been carried on between this Committee and the Executive Committee with now only a few last-minute details remaining to be settled; it is expected that the document will be readied for final action by the Executive Committee at its December 1949 meeting, for membership action shortly thereafter.

Section and Membership Relations

Activity here, under the Sections and Membership Relations Committee headed by Nelson Gildersleeve, has functioned on a very high level. Particularly to be noted is Bulletin No. 2, of this Committee, which summarizes important items in the operation of a Section, helpful in maintaining members' interest. The Committee has prepared a membership kit for new sections, and has made a review of Society literature and procedures affecting the Sections and the individual members. It has aptly been pointed out by the Committee that each Director should consider it his duty to discuss national ISA affairs with his Section, to keep the membership aware of all that is going on. It is felt that few of our members realize the extent of the national activities, hence quite often wonder about the purpose of a national organization. Through the meetings of the Board of Directors, and interim reports sent to the Directors from time to time, members of the Board are kept informed of the national activities. The general morale of the membership can be kept on a high level if the individual Directors will take it upon themselves to pass this information along to their Section membership.

1950 Budget, Revised from Finance Committee Report Dated 7-12-49

Budget Summary

Item	Expenses	Income
Membership Activities	$14,350.00	$22,400.00
Meeting Activities	12,900.00	5,500.00
Shows & Exhibits	24,100.00	45,000.00
National Headquarters	13,275.00	
Administrative Activities	3,000.00	1,200.00
	$67,625.00	$74,100.00
***Contingency Fund	3,325.00	
Less Expenses:		70,950.00
Anticipated increase in Surplus Acct.		$ 3,150.00

***This budget is based on the best data available at the present time; however, it is not considered by the Committee to be sufficiently accurate to permit budgeting to exact amounts in many instances. The contingency fund of $3,325.00 has been provided subject to distribution by authority of the Executive Committee. It is recommended that this contingency fund be used sparingly, and be applied to inadequately budgeted items only.

Detailed Budget

1—Membership Activities:

Expenses:

No.	Description	Amount
102	Maintenance of membership records (stencils, listings, cards, billheads, etc.)	$ 450.00
103	Membership promotion of general nature (printing, ads, booklets, etc.)	2,500.00
*104	Membership promotion of specific nature (services to Sections, persons, etc.)	400.00
105	Subscriptions to Instruments Magazine	6,000.00
**107	Purchase of Insignia (for resale)	2,000.00
120	Technical material to members (Recommended Practices releases, binders, Proceedings, etc.)	3,000.00
	Total expenses	$14,350.00

Revenue:

201	Membership Dues (4,000 at $5.00)	$20,000.00
*204	Payments for services to Sections	400.00
**207	Sales of insignia	2,000.00
	Total revenue	$22,400.00
	NOTE: We estimate a net income from Membership activities of	$ 8,050.00

*) **)—Self-sustaining items.

2—Meetings & Conferences:

Expenses:

No.	Description	Amount
300	Promotional matters and notices (printing, mailing, etc.)	$ 1,500.00
301	Registration materials & cost (badges, tickets, etc.)	300.00
302	Program preparation & printing	1,000.00
303	Program mailing & distribution	600.00
304	Rental of meeting halls or rooms	1,000.00
305	Meeting Accessories	1,500.00
*309	Preparation of preprints of Technical Papers	2,000.00
346	Expenses of National Office Staff (½ of allowance—balance charged to Exhibit)	1,800.00
347	Travel allowances for speakers.	200.00
**348	Lunch & Dinner (Banquet) Expenses	3,000.00
	Total Expenses	$12,900.00

Revenue:

400	Registration Fees	$ 500.00
*409	Sale of Technical Preprints	2,000.00
**448	Sale of Lunch & Dinner Tickets	3,000.00
	Total Revenue	$ 5,500.00
	NOTE: We estimate a net cost from activities related to meetings and conferences of	$ 7,400.00

*) **)—Self-sustaining items.

3—National Exhibits & Shows:

Expenses:

No.	Description	Amount
502	Public Relations & Advertising	$ 1,500.00
506	Cost of Services related to Exhibit Space (Service Contractor, guards, etc.)	5,600.00
509	Printing Space Contracts, Programs, etc.	3,500.00
510	Registration material, cards, badges, etc.	500.00
511	Registration labor	500.00
514	Show Management Salaries	7,400.00
515	Expenses of Show Manager & Staff (½ of allowance—balance charged to Meetings & Conferences)	1,800.00
519	Attendance Analysis (questionnaires, surveys, reports, etc.)	2,000.00
597	Insurance protection, etc.	300.00
599	Miscellaneous	1,000.00
	Total Expenses	1,100.00

Revenue:

605	Sale of Exhibit Space (18,000 sq. ft. @ $2.50/sq. ft.)	7,000.00
	NOTE: We estimate a net income from Exhibits & Shows of	9,300.00

4—National Headquarters:

Expenses:

No.	Description	Amount
701	Office Rent	600.00
703	Office Equipment	500.00
704	Stationery & Supplies	1,000.00
705	Postage, mailing, etc.	2,000.00
706	Telephone & Telegrams	1,000.00
712	Non-executive Salaries	7,600.00
714	Insurance Coverage	50.00
717	Personnel Bond	25.00
799	Miscellaneous	500.00
	Total Expense	$13,275.00

5—Administration & Executive Activities:

Expenses:

No.	Description	Amount
*903	Editorial Work for I.S.A. Journal	$ 1,200.00
951	Expenses of Employment Committee	200.00
952	Expenses of Nominating Committee	50.00
953	Expenses of Recommended Practices Committee	200.00
954	Expenses of Sections & Membership Committee	50.00
960	Expenses of President's Office	200.00
970	Expenses of Vice-Pres. Office	200.00
980	Expenses of Treasurer's Office	100.00
990	Legal Expenses	100.00
991	Auditing Expenses	100.00
	Total Expenses	$ 3,000.00

Revenue:

*1003	Payments by Instruments Publishing Company for I.S.A. Journal Copy	$ 1,200.00
	NOTE: We estimate a net cost from Administrative & Executive activities of	$ 1,800.00

*Self-sustaining items.

National Defense Affairs

Our interest in public matters within this catagory is obvious. One of the items on which ISA can be of national service is to assist the United States Employment Service in the establishment of man-power specifications through job description. Ultimately a questionnaire on this subject will be issued by USES; Ralph Goetzenberger, Chairman of our National Defense Committee, has urged that our membership send all information of this kind to his Committee.

Recommended Practices

The sustained activity of the Recommended Practices Committee during the past year, under the chairmanship of J. G. Kerley, may well excite the admiration and pride of the Society, for in this work ISA will receive recognition for its contribution to the progress of instrumentation. The agenda for the Toronto meeting of this important committee, by way of example, covered twelve different items of Practice on which sub-committees are at work, including Flow Plan Symbols, which will be reported on at the Annual Business Meeting on September 12.

Nominating Procedure

During the year, though off to a belated start, the Nominating Committee composed of representatives of different regional areas, in accordance with the desire of the Board of Directors as expressed at the 1948 Philadelphia meeting, was duly constituted and operated under the chairmanship of Ralph D. Webb. In accordance with our new plan, this committee reported at the Toronto meeting, its report being accepted and the committee duly discharged.

To insure prompt constitution of the

Nominating Committee for the ensuing year, it is planned to have the different areas of ISA designate their choice for committee membership before adjournment of the Board of Directors meeting on September 10.

It is noted, incidentally, that a change in date of accession to office is proposed, the new set of officers to take over on January 1 for the year to December 31. The thought here is that such procedure would give the newly elected officers a period of about three months, after the September election, to formulate their plans for their ensuing administration, thus to improve the Society operation from the viewpoint of Standing Committee appointment—the backbone of Society development.

Publication Policy

After a careful study, the Executive Committee has recognized that the entire matter of Journal publication must now be carefully reviewed in all its phases. For this purpose a special committee on Journal Publication is to be appointed, and for this, L. H. Allen has accepted the post of chairman. At the July Executive Committee meeting, the desire of Editor Hildenbrand to be relieved of this post, after some eighteen months of faithful service, was recognized, and his resignation accepted.

National Secretariat

Despite the urgency of the question of setting up a permanent secretariat with adequate management personnel, the National Secretariat Committee under chairmanship of F. H. Trapnell, though working on the problem throughout the year, has not yet been able to make its final recommendation. This has been partly because the financial status of the Society has not been entirely clear. However, this situation, as noted previously, is now rapidly being clarified by the development of our accounting procedures. In addition, the question of policy with respect to Journal publication enters the picture. The Committee has expressed the hope that the problem of the national secretariat may be resolved before the end of this year.

Exhibit Policy

At the meeting of the Board in Philadelphia last year, there was a lengthy discussion of a proposal, emanating from a group representing most of the exhibitors in our annual exhibit, that exhibits in the future to be held on a bi-annual basis. It was brought out, on one hand, that our membership receives considerable benefit from the annual Exhibit, and on the other hand, that the exhibitors feel the program of annual exhibits represents an increasingly heavy financial problem to them. It was requested that the subject be further reviewed, so that the Directors could take some policy action at a later meeting. Accordingly, your President appointed a Special Committee on Exhibit Policy to study this knotty problem, under the chairmanship of Ralph R. Batcher, and under the supervision of Vice-president Frost.

During the year the Committee has worked diligently to arrive at some satisfactory solution which could be mutually agreeable to both the exhibitors and the membership. Many long-range policies are involved. The exhibitors have seen their costs rising annually as a result of participation in larger and larger exhibits. They have seen the Society select locations for these exhibits which include, on one hand, areas in which large user concentration might be expected, and on the other hand, such areas where there might be some question whether the user concentration would be large enough to justify their costs. They anticipate an era of lower business activity, in which it may be necessary to curtail their advertising expense. In addition to the above, they are concerned about certain minor problems involved in the conduct of the Exhibit; these, however, should not be difficult to resolve once a decision is reached on the major issues. Throughout many hours spent in attempting a solution, the exhibitors have displayed a fine spirit of cooperation.

It is obvious that each year, running parallel with the Annual Conference, the Exhibit has provided a focal point for the activities of the Society. The two simultaneous activities give members and non-members an opportunity to participate in a week of intensive activity during which many new ideas are obtained and many old problems are brought closer to solution. Among the members, the feeling persists that the Exhibit materially increases the benefits of ISA to its members. Also, were the Exhibit held bi-annually, it would take at least twice as long before it would return to a particular area. This is of considerable importance to those members who do not have the opportunity to travel great distances to other areas. Finally, of specific interest to the Society is the fact that its yearly income has been appreciably augmented as a result of the annual shows.

The Committee was unable to resolve these problems and to agree on a satisfactory policy which could be submitted to the Board of Directors. The Committee had recommended that a new standing committee be formed, comprised of personnel from both the exhibitor's and the users' groups, and that this committee be permitted broad authority in setting future authority for the Exhibit. Since this proposal did not allow the Directors to take action on a policy which would define the duties and responsibilities of the standing committee, it was considered unacceptable by your Executive Committee: i.e., the standing committee would be making, rather than administering policy. At its last meeting, the Executive Committee acknowledged, with grateful thanks, the receipt of the special committee's report, and relieved it of further responsibility in the study of the problem. At the same time, the Executive Committee agreed to assign this problem of policy to the Committee on Society Structure and Planning for early consideration; it further recognized, since the Exhibit runs simultaneously with the Annual Conference, that the supervision of the Exhibit from the general Society viewpoint (as distinguished from the business management viewpoint) fell within the province of the Meetings Committee, and should so be definitely identified.

Abstracting Service

At numerous times in the past, members have requested that the Society undertake a program covering general distribution of abstracts of technical articles appearing in different publications representative of our many fields of interest. The Executive Committee took this problem under advisement, and requested the First Vice-president to explore the possibilities as well as the problems of such a program. Sufficient interest was indicated, in a preliminary survey, to justify further investigation by a committee, charged with eventual recommendations for action by the Board of Directors. The executive Committee authorized the formation of the Abstracting Service Committee, and subsequently George F. Gardner accepted its chairmanship; the work is now under way.

Society Structure and Planning

During the year 1947-1948, the Executive Committee recognized that the administration of Society activities was not organized in a manner to permit effective functioning by the officers and by the various committees of the Society. As a result, the formation of administrative Division was recommended; this arrangement is now in effect with beneficial results. Even though, in developing this organizational pattern for efficient administration, considerable effort had been expended, it was soon recognized that long-term consideration of the Society's needs might indicate further changes not only in the organizational pattern but also in Society policies.

So that a separate group could carefully consider problems related to the Society's growth as well as such others dealing with long-range policies, the Executive Committee authorized the formation of a Committee on Society Structure and Planning. This Committee is now to be set up as a Standing Committee of the Society through action of the Board of Directors. A. H. Shafer, long identified with the development of the Society, has accepted the chairmanship. It is considered of particular importance that members of this Committee have broad experience and high standing in the industry to properly strengthen their activity.

At its last meeting, the Executive Committee assigned certain specific problems to this committee for consideration. These include:

(a) Possibility of increasing Society income, in addition to assuring financial stability under conditions of reduced business activity.

(b) Consideration of question of Company members for the Society, either instrument manufacturers or users, or both.

(c) Study, with recommendations, of general Exhibit policy, taking into consideration the frequency, locations, types of exhibits, as well as administration of exhibit policy.

(d) Review of the entire Society structure with regard to present Standing Committees, the completeness and suitability of the definitions of duties for these committees, as well as their allocation to the proper administrative Division.

(e) Executive Committee to study Nominating Procedure.

It is not expected that this committee will resolve its assigned and implied

problems hurriedly, but rather that it will proceed with thoughtful deliberation.

In conclusion, the President wishes to pay grateful and personal tribute to his colleagues on the Executive Committee, and to all of his other Society co-workers, too many to name individually, for their efforts to insure the success of ISA during the past year. Through their fine spirit of cooperation, their unselfish contribution of time and effort, their fostering of strength and development in ISA for the mutual stimulation that this produces—through all t[illegible]e the year has been one of sustained [illegible]spira-tion to him. May such inspirati[illegible] be the lot of each and every membe[illegible] in the years to come!

CARL F. KAYAN,
President.

Views of the Clinic. Instructors were furnished by American Meter Company, Bailey Meter Company, Bristol Company, Foxboro Company, Gow-Mac Instrument Company, Leeds & Northrup Company, Manning, Maxwell & Moore, Inc., Republic Flow Meters Company, Taylor Instrument Companies, Wheelco Instruments Company.

Flashbacks *of* ISA St. Louis Meeting

by Susany

(At the right) Jim and Mrs. Mozley with two of his Clinic students and their dates.

(Below) Some of those in this group on the S. S. Admiral are Dr. and Mrs. Munch, Secretary and Mrs. Rimbach, Mr. Rolfing the feature speaker and standing left to right are Sam Prince, Al Shafer, Reg Pigott and Ed Fiske.

(Above) Dancing to the S. S. Admiral band.

Erecting the sign at the entrance to the St. Louis Auditorium on Wednesday before the Meeting.

Exhibit Floor Manager Cy Goldcamp giving last minute instructions to Misses Kiger and Jarrett of the National Office staff.

Secretary Rimbach discussing final arrangements with Statler Sales Manager Jack Wilder and his assistant Tom McAlvey.

The Annual Business Meeting at which President Kayan presided.

The Board of Directors' Meeting on Saturday, September 10 at the Jefferson Hotel.

The speakers' breakfast meeting on Monday morning.

The meeting on the S. S. Admiral being addressed by Mr. Rolfing, President of Excavations and Holes, Inc.

Report of National Treasurer

In March 1949, the Society engaged Mr. J. A. Hollingsworth, a Certified Public Accountant of Pittsburgh, Pennsylvania, to

(a) review the accounting and bookkeeping that had been performed by the Secretary and Treasurer during past years;

(b) assist in the establishment of a modern system of accounting and budget control at Headquarters; and

(c) provide a certified statement of the Society's financial condition.

In August 1949, Mr. Hollingsworth reported that during the first three years of its formal existence, the receipts by the Society were as follows:

	1946	1947	1948
200—Membership Dues & Payments	$8,281.43	$21,477.95	$29,355.52
400—Meetings and Conferences		4,104.00	6,307.78
600—National Exhibits		42,407.11a	52,838.14
1000—Administration	136.67	1,380.13	911.14
Totals	$8,418.10	$69,369.19	$89,413.13

(a, includes $8,342.11 net from Pittsburgh Exhibit, 1946)

The expenditures during that period were reported to have been as follows:

	1946	1947	1948
100—Membership Activities Dues Distbn	$2,904.12	$19,703.34	$26,011.14
300—Meetings & Conference	145.00	10,701.70	11,806.58
500—Exhibits	125.00	15,425.21	22,474.97
700—National Headquarters	933.69	7,529.06	10,537.01
900—Administration	330.31	3,011.19	6,263.15
Totals	$4,438.12	$56,370.50	$77,092.85
Surpluses	$3,979.98	$12,998.69	$12,320.28

On December 31, 1948, the Society's account in the Live Stock National Bank of Chicago contained $27,893.15—and in the Bank of Nova Scotia, Toronto, $1,521.00. The sum of these deposits, $29,414.15, corresponded to the total of the surpluses for the three years, $29,298.95.

In the period January 1 to July 31, 1949, the Society received and expended the following amounts:

	Income	Expense
100- 200 Membership Activities	$20,902.42	$18,155.29
300- 400 Meetings & Conferences	964.57	751.24
500- 600 Exhibits	50,119.20	3,451.68
700- 800 Headquarters	19.14	11,478.55
900-1000 Administration	571.99	2,940.87
Totals	$72,577.32	$36,777.63

The surplus of the first seven months of 1949 was $35,799.69—which, added to the surplus of $29,298.95 from previous years, indicated gross assets, as of July 31, 1949, of $65,098.64. Deposits to the credit of the Society in various banks at the end of July were reported to be as follows:

Live Stock National Bank, Chicago	$15,689.24
Bank of Nova Scotia, Toronto	1,521.00
West End Bank, Pittsburgh	19,795.76
Farmers Deposit National Bank, Pittsburgh	28,201.34
Total	$65,207.34

Against these cash assets, there were liabilities for taxes, the St. Louis Exhibit, uncashed vouchers, etc., totalling $46,776.22—so that on July 31, 1949, the Society had a surplus available for future needs, of $18,431.12. Therefore, in fulfillment of actions by the Board of Directors in meetings of September 1947 and 1948, in August the Treasurer and Secretary undertook the purchase, in the name of the Society, of two $5,000 U. S. Government Bonds.

With the establishment during April and May of a comprehensive budgeting and accounting system at Society Headquarters, there has been a gradual transfer of the Society's funds from a Chicago bank to two Pittsburgh banks—effected by paying all expenses from the Chicago account, and making all deposits in the West End Bank, and the Farmers Deposit National Bank of Pittsburgh.

In the past it has been our practice to avoid any distinction between the revenue derived from annual exhibits and conferences, and that derived from membership dues, sales of technical papers, etc.—because both were vitally necessary to the solvency of the Society. In July the Society was formally recognized as a non-profit organization by the Treasury Department. Therefore, in the future it will be practical to use two bank accounts to differentiate between membership and non-membership revenues.

The Society should feel greatly indebted to the Budget and Finance Committee (specifically Messrs. George Feeley and Al Shafer), and to the National Secretary Richard Rimbach and his assistant John J. McCaffrey, for the excellent work they have done in improving and stabilizing the budgeting and accounting procedures of the organization.

HUGH E. FERGUSON
National Treasurer.

Report of Executive Secretary

Due to the shortage of help in the National Office it was not possible for the Secretary to prepare a complete report on the National Office activities for the Board of Directors Meeting.

A number of changes have taken place in the National Office since the Philadelphia Meeting. At that time the office personnel consisted of Misses Jarrett and Cummins. Miss Cummins left shortly thereafter, but no replacement was made until the employment of Mr. John McCaffery in late December. Shortly after the new year, Miss Kiger was employed.

The new address of the National Office is 921 Ridge Avenue, Pittsburgh. Members are invited to visit the National Office if they should be in Pittsburgh.

Membership and New Sections

The membership of the Society has increased as shown below:

Membership September 1, 1949

Section	M	AM	SM	Total
Akron	43			43
Aruba	59			59
Atlanta	19	1		20
Baltimore	65	3	1	69
Boston	86			86
California	164			164
Central Illinois	29	1		30
Central Indiana	18	58	2	78
Charleston	69	11	1	81
Chicago	232	28	39	299
China Lake	86			86
Cincinnati	65			65
Cleveland	114	5	3	122
Columbus	20	2		22
Cumberland	12	3		15
Detroit	69	2	4	75
Eastern New York	49		41	90
Gulf Coast	27	14	1	42
Houston	111	2		113
Kansas City	30	22	1	53
Louisville	34	3		
Montreal	72			
New Jersey	227			
New Orleans	4			
New York	182	15		
Niagara Frontier	67	22		
North Texas	39	1		
Northern Indiana	6	17		
Oak Ridge	67			
Ontario	42	1		
Philadelphia	325	47		
Pittsburgh	188	7		
Presque Isle	18	4		
Richland	75	23		
Rochester	67			
St. Louis	111			
Sarnia	62	15		
South Bend	2	7		
Southern Michigan	20	12		
South Texas	36	10		
Tennessee	21	20		
Tulsa	76	5		
Twin Cities	20	24		
Washington	52	91		
Wayne County	31	14		
At Large	23	3		
	3234	493	153	

Growth of Membership

Date	Total Members	Number of Sections
8/46	1075	18
12/46	1650	23
4/47	2121	27
8/47	2296	32
3/48	2966	38
8/48	3280	41
3/49	3762	44
5/49	3908	44
9/49	4090*	48

(*Includes Albuquerque, Baton Rouge and North California).

Note that the number of local sections is now 48. The sections granted charters since the 1948 annual meeting are:

Section	Date Charter Granted	Section Number
China Lake	1/ 7/49	43
North Texas	2/16/49	44
Baton Rouge	5/10/49	45
Albuquerque	7/16/49	46
Columbus	7/16/49	47
Northern California	9/ 7/49	48

Since the Toronto Meeting, the Secretary met with a group at New Martinsville and discussed the organization of an Ohio River Valley Section.

Visits of Secretary to Local Sections

Since the September Annual Meeting, the Secretary has attended the following Section Meetings:

Eastern New York	October 5th
California	October 19th
New York	November 29th
Akron	February 22nd
Buffalo	February 28th
Ontario	March 1st
St. Louis	March 2nd
Columbus	April 28th

Co-sponsoring Societies

Industrial Instruments & Regulators Div., American Society of Mechanical Engineers
Instruments and Measurements Committee, American Institute of Electrical Engineers
American Institute of Physics
National Telemetering Forum
Institute of Radio Engineers
Scientific Apparatus Makers Ass'n.

The Secretary has had the pleasure of working with a most cooperative St. Louis Convention Committee. The Secretary requests that the Board of Directors pass a resolution of appreciation to the members of the St. Louis Convention Committee and the National Meetings Committee.

Reclassification of Associate and Student Members

The following results were obtained by 3 letters to the Sections:

Authorized changes from Associate to Member	168
Authorized changes from Student to Member	34
Total authorized changes to Member	202

6 Sections with a total of 16 Associates did not reply.
98 Associates are now being reviewed.

RICHARD RIMBACH
Executive Secretary

Instrumentation Flow Plan Symbols*

By DAVID E. HOSTEDLER**

I feel quite honored to have been asked to tell you a little about one of the typical ISA activities.

Our officers and committee chairmen have described the various activities and accomplishments of our Society. As a demonstration of this, they believe you will be interested in one of our Recommended Practices Committee projects: "Instrumentation Flow Plan Symbols."

Recommended Practices Committee

Among the committees that you have heard about from the previous speakers you will recall the "Recommended Practices Committee," and before going further I want to tell you briefly who they are and what they do.

This committee is made up of about twenty-five men who represent a variety of industries, but who have in common an active interest in instrumentation. The sum total of years of instrument experience represented is a quite substantial figure. Their job can best be explained by quoting the "Purpose" of the committee:

"To study technical practices in instrumentation and to prepare and recommend uniform practices; where adoption of such uniformity would simplify work, facilitate general understanding and interchange of information; and to promote their general adoption."

The individual members of the Recommended Practices Committee are assigned projects to develop and each such man then sets up a Sub-committee, and serves as its chairman, to do the work necessary on that particular project. The topic assigned to my Sub-committee was that of developing recommendations for uniformity of instrument symbols.

History of Sub-committee

This topic was one which was very much to my liking. It is one with which I've been associated in my daily work for a number of years. It has been a source of annoyance to deal with the different practices that are followed by different companies or organizations, and even by different plants within the same company. Within the last several years even the isolated individual plant has become very much aware of the need for a uniform practice in instrument symbols.

It is very doubtful if it is necessary to tell any of you what we mean by "Instrumentation Flow Plan Symbols." However, since "Instrumentation," and our Society's activities, spread to rather wide limits, it will be advisable to give some definitions.

A "Flow Plan" is a quite general term and can refer to a wide variety of drawings that illustrate a process or almost any operation. It is a method that is used extensively by industries today to record on paper the "story" of a plant, a process, or an operation. It can be described as the drawing, or diagram, of the process; consisting of representations of the various equipment items and interconnecting piping, and incorporating various other data and information pertaining to the design and operation of the process. It is often called a "flow sheet" or a "flow diagram" and its character will depend entirely upon the *use* for which it is intended.

Sometimes a Flow Plan is drawn specifically to show the instrumentation and it would then include data pertinent to this phase of the work. On all kinds of flow plans it is necessary to depict items of instrument equipment and very often to identify such equipment either generally or specifically. Here is where the instrumentation symbol comes in, and we define it as "any shaped or pictorial representation of an instrumentation item; with or without letters of identification." We define identifications as the letters (and numbers if any) used to identify any such item, whether shown as a part of a symbol or written separately.

Returning to our Sub-committee, assigned the project of studying such symbols, our first job was to name members who would be willing to put some time and energy into the task.

The Work of the Sub-committee

After the committee was formed we held a meeting and agreed that our first move should be to conduct a survey—one that would be as extensive as we could possibly handle. We felt that we should be as fully informed as possible on what people were now doing when they wanted to show an instrument equipment item on a flow sheet.

We were well aware that a lot of people had spent plenty of time studying and developing systems of instrument symbols suitable for their own requirements and we wanted to profit by all such thoughts and experiences. To be able to ask some sensible questions and obtain some useful answers we also agreed that it would be necessary to draft a typical symbol system to accompany our survey questionnaire. We had collected quite a few of the systems already in use by various companies. We also had the joint knowledge of our committee members, from their experience in working with flow diagrams, specification sheets and such data. We took all of this information and started to make up a composite typical system, trying to utilize the best ideas in each of our sources.

It was at the time of drafting our typical system for survey purposes that we began to fully realize how divergent the view points were on the subject. Even though this system was the starting point of our project we found that it took a number of meetings, and some lengthy discussions to reach complete agreement within our own committee. However, we did reach mutual agreement, and mailed out the system that we had assembled, and which we called a "Suggested" System. With it was a questionnaire.

A large mailing list had been accumulated for our survey. The names were obtained from a number of sources, all ISA Sections were asked to give us the names of members in their section who would be interested. We did our best to reach everyone who could help us on the problem, and I'm sure that many of you fellows were included. About 350 questionnaires were mailed and of these over 140 replied. The type of response was excellent. The variety and sheer volume of the returns was something to reckon with. This phase of our job was where the most work was necessary. They not only had to be read but had to be digested and the useful suggestions extracted and grouped to get summarized opinion.

While the variety of reply was very great it should be emphasized that there was a majority that were in substantial agreement in basic principle. Most of the differences were in matter of detail. The only appreciable differences in main principle seemed, and still seem to be, the result of the purpose for which the individual uses instrument symbols and his method of handling his work. Three noticeable groups of divergent main principle were:

(a) Those who prefer an overall identification for instrument and all of its parts.

(b) Those who want a separate identity for each part or component such as receiver, transmitter, valve.

(c) Those who wish to identify an item by its strict functional class without any relation to its process use. For example, a pneumatic receiver would be classified as a pressure instrument even if served as a flow recorder in application. This latter group appeared more generally among the manufacturers.

You will be interested in a few examples of the symbols systems now in use, copies of which were sent in when answering the questionnaire. Typical of quite a few is the very simple list of the various instrumentation items that the company uses most often, with a circle or other shaped character to show the item on flow sheets and two or three letters to establish its identity. These quite often included only 15 to 20 items and appear to be more of a list that has grown as new types were used rather than a planned system. Generally the identifications are initial letters of the words commonly used to speak of such instruments and the same letter often

*Presented at the Fourth Annual Conference of the Instrument Society of America, Sept. 12-16, 1949, St. Louis, Mo.

**Foster Wheeler Corporation.

will have different meaning for different items. For example in the combination IPC the letter "P" stands for pressure while in IP it stands for pyrometer. Such "lists" are generally incomplete and the sequence of letters in the identifications are not systematic. PR will be used for pressure recorder while RPC will signify pressure recording controller.

Typical of another group is the well designed system which is very complete and very elaborate, and with which, if one knows the code, or rather if he has his code book handy, he can tell almost anything he wants to know about an item. Here again, such a system no doubt fulfills perfectly the needs of the man who developed it but could not be feasible for use of everyone. There was one instance where just picking at random a pair of orifice flanges for a flow meter we found that the identification would contain nine letters, a period, a dash, plus an item number.

We can sum up the different types of systems now in use by stating that they range from the ultra simple and incomplete to the ultra complex and very complete. Logic indicates that somewhere between these limits there is a system which will be useful to the greatest number.

To analyze the results of our survey we made a tabulation of the yes and no votes on the specific questions. We then tabulated each request, suggestion or preference that was included in a separate letter or written in on the questionnaire. All those alike were then grouped, and both these and the yes and no answers were expressed in percentage of the total number of replies.

The summarized results of our survey indicated three things:

(1) That a majority preferred the *type* of system that we had sent out.

(2) That the preference was for it to be a little more complete.

(3) That the lack of completeness was in the need for identifications for additional process variables and variations of same.

As an interesting side light I would like to point out that if our results can be utilized for such purpose the manufacturers of pH instruments should get prepared for a boom, 35 percent of the people replying requested a symbol be provided for pH. On the other hand only 3½ percent thought that a symbol for time instruments was necessary. We think this may be related to the extent to which certain types are ever shown on flow sheets. In any event we made modifications in our system consistent with the results of the survey.

Since our survey work and the analysis had been made by a group that was limited in number, we felt that our efforts should have the scrutiny of a much larger and wider committee. To do this we selected about 25 additional members which we called the Review Board Members. Each of these men was sent a very complete binder of the work that had been done: minutes of meetings, digest and summary of all questionnaire replies, etc.

First Accomplishment—Tentative Approval

After studying our efforts a majority of our Review Board indicated that we had done a sufficiently thorough job and that our report was ready to be acted upon by the Recommended Practices Committee. In view of the majority opinion the report was submitted to the Recommended Practices Committee, with a transcript of our Review Board replies. It was approved by them and will be distributed to ISA members soon. Anyone else interested can obtain copies for a nominal sum.

Description of System

The system can best be described by treating it in two phases; first the identifications, and secondly the shaped or pictorial symbol used to illustrate the item on a drawing. The identifications are by far the most important and are quite complete in themselves. This is necessary since these identifications will be used in written work; on listings, requisitions, and specification sheets; and even in speech. They must tell the full story without pictorial symbol.

The identifications consist of combinations of two or three letters of the alphabet, written in upper case. The first letter in any combination indicates the process variable being measured or the actuation means. The second letter indicates the type of reading or other function. The third letter, when necessary, indicates the additional function of the item. To avoid any possibility of misinterpreting the meaning of a letter each is allowed only one possible definition when used as a first letter. Also each is permitted only one definition when used as *either* the second or third letter of any combination. The letters of the alphabet that are used, with the definition or significance of each, and the permissible position or positions in which each may be used, have been set listed in Table No. 1. This table can be understood very readily and requires no further explanation. Table No. 2 has been included to show all the possible and permissible combinations of letters, and will be found very useful. It is drawn with horizontal and vertical columns, the horizontals covering the process variables and the verticals covering the type of device. The rectangle at the intersection of any two columns contains the complete combination of letters for identification of an instrument, and the definition of any such combination is obvious from the headings of the two columns involved. It will be noted that the intersections of certain columns have been shaded. These would have represented what, so far as we can see, would be an impossible instrument. Other intersections are left blank because such an instrument would be improbable. You will note that these combinations of letters give what we have termed "General Identification." They tell what the instrument measures and what functions it performs. If a specific identity is required, such as telling which is number one flow recorder and which is number two, the letter combination would be followed by a dash and then a number of this nature.

Since the identifications tell a very complete story in themselves the pictorial or shaped symbols become a relatively simple problem. If the identifications are used with them there is no necessity to draw variously shaped devices on flow sheets to depict the different types of item. You will therefore find that the shaped part of the symbol has been kept very simple for the maximum ease of drafting. All instrument proper and most other instrumentation items are illustrated by circles approximately 7/16" diameter. The circle has been used because no other shape can be drawn so readily, either with or without a template. It is also the shape that is used far more than any other in present practice. For combination instruments that measure more than one kind of variable or provide more than one function, separate circles are drawn for each, with the edges overlapping slightly to show that they are combined in a single case. Transmitters are also drawn as circles, but with two diagonal diameters drawn through the circle to form an "X." To show that any instrument is mounted on the control room board a horizontal diameter is drawn through the circle.

Getting away from the instruments proper, the symbols that are provided to illustrate diaphragm motor and other kinds of valve items are essentially the same as the ones that are used most widely in present practice. The diaphragm valve symbol is the very familiar mushroom sitting on top of the conventional symbol for a valve body.

Symbols are included for the connecting lines of instrumentation. These are different styles of lines for piping, air line, electric wiring and capillary tubing.

Salient Points & Limitations of System

The system that is included in this paper is not at all a new one. It is almost entirely a consolidation of the most widely followed present practice and the best ideas that could be taken from existing systems. It is primarily suited to the needs of the process industries but can be used easily in similar industries; such as steam generation, fluid materials handling and air conditioning. It is not intended for use in such fields as aircraft, navigation, and astronomy, where the equipment is too different to make it feasible.

While the main use of the system is in connection with Flow Plans it will also serve the following purposes:

(1) For recording items in specifications, listings requisitions, and order sheets.

(2) To indicate items on piping and other construction drawings.

(3) For identification tagging of equipment.

(4) For use in technical and trade literature and drawings.

No attempt has been made to include a method of showing the specific identity of items. The type of item or serial numbering system used depends entirely on its purpose, and any kind may be used with these general identifications.

One of the greatest problems encountered in developing a symbol system is determining the degree of simplicity or completeness necessary. One is attained only at the expense of the other. We have been anxious to make this one useful to the greatest number of people and have therefore leaned as far as practical to the side of simplicity.

Any changes that may be found necessary in this system would surely be additions that would make it more complex. It is the basic nature of such things that they never become more simple with change. Therefore if any of you should feel after using the system that it is not complete enough let us be cautious in making changes that would make it more complicated.

Here are a few things that some may consider limitations:

(1) Only the more common process variables are included.

(2) Only the most important information about a device is shown.

(3) It does not give any means of separately identifying transmitters, valves, or accessories.

Criticisms Received

We have already received a few criticisms. We expect that we will receive more after it is published. Of the criticisms received so far almost all were on matters of detail. One very thorough letter of constructive criticism received, is outstanding in that it is concerned with basic principles rather than details. In brief, the principle suggested is that the system should:

(a) Provide a language which can be read and understood by all users.

(b) Provide freedom of expression, permitting the individual user to depict his applications in that degree of detail or generality which best suits his requirements. In other words, while a letter used in identification always would have definite meaning, a user could apply his identification to the complete instrument application, or he could separately identify each component, or he could identify each component by its true character.

These suggestions are being studied very carefully by the committee.

Future Plans

(1) To promote general acceptance of the tentative practice.

(2) To study all criticisms, suggestions and ideas received on the subject. We solicit all of your criticisms—but please put them in writing so that they can be reviewed satisfactorily.

(3) To cooperate with the British Standards Institution; the hope being to reach eventual complete agreement with them on instrument symbols.

Table No. 1. Letters of Identification

DEFINITION, AND PERMISSIBLE POSITIONS IN ANY COMBINATION			
UPPER CASE LETTER	FIRST LETTER Process Variable or Actuation	SECOND LETTER Type Reading or Other Function	THIRD LETTER Additional Function
A	....	Alarm	Alarm
C	Conductivity	Control	Control
D	Density	....	....
E	....	Element (Primary)	....
F	Flow	....	....
G	....	Glass (No Measurement)	....
H	Hand (Actuated)	....	....
I	....	Indicating	....
L	Level	....	....
M	Moisture	....	....
P	Pressure	....	....
R	....	Recording (Recorder)	....
S	Speed	Safety	....
T	Temperature	....	....
V	Viscosity	....	Valve
W	Weight	Well	....

NOTE 1: When required the following may be used optionally as a first letter for other process variables:
(1) "A" may be used to cover all types of analyzing instruments.
(2) Readily recognized self-defining chemical symbols such as CO_2, O_2, etc. may be used for these specific analysis instruments.
(3) The self-defining symbol "pH" may be used for Hydrogen ion concentration.

NOTE 2: Although not a preferred procedure, when considered necessary it is permissible to insert a lower case "r" after "F" to distinguish Flow Ratio. Likewise, lower case "d" may be inserted after "T" or "P" to distinguish Temperature Difference or Pressure Difference.

TABLE NO. 2. COMPLETE GENERAL IDENTIFICATIONS (COMBINATIONS OF LETTERS)

FIRST LETTER (OR ACTUATION) — PROCESS VARIABLE		SECOND AND THIRD LETTERS (TYPE OF DEVICE) — CONTROLLING DEVICES: Recording	Indicating	Blind	Self-Actuated (Integral) Regulators & Valves	Safety (Relief) Valves	MEASURING DEVICES: Recording	Indicating	Glass Devices for Observation Only (No Measurement)	ALARM DEVICES: Recording	Indicating	Blind	Primary Element	Wells
SHADED (/) OR ACTUAL COMBINATIONS		Remote Controllers												
BLANK IMPROBABLE COMBINATIONS		-RC	-IC	-C	-CV	-SV	-R	-I	-G	-RA	-IA	-A	-E	-W
Temperature	T-	TRC	TIC	TC	TCV	TSV	TR	TI	//	TRA	TIA	TA	TE	TW
Flow	F-	FRC	FIC				FR	FI	FG	FRA	FIA		FE	//
Level	L-	LRC	LIC	LC	LCV		LR	LI	LG	LRA	LIA	LA		//
Pressure	P-	PRC	PIC	PC	PCV	PSV	PR	PI	//	PRA	PIA	PA	PE	//
Density	D-	DRC	DIC	DC			DR	DI	//	DRA	DIA			//
Hand	H-		HIC	HC	HCV		//	//	//	//	//		//	//
Moisture	M-	MRC	MIC	MC			MR	MI	//	MRA	MIA	MA	ME	//
Conductivity	C-	CRC	CIC				CR	CI	//	CRA	CIA	CA	CE	//
Speed	S-	SRC	SIC	SC	SCV	SSV	SR	SI		SRA	SIA	SA		//
Viscosity	V-	VRC	VIC				VR	VI	VG	VRA	VIA			//
Weight	W-	WRC	WIC				WR	WI		WRA	WIA		WE	//

NOTE: The optional additional process variables given in footnotes of TABLE NO. 1, when used, shall be combined with second and third letters as per above.

ISA EMPLOYMENT SERVICE

Forward your letter to INSTRUMENT SOCIETY OF AMERICA, 921 Ridge Ave., Pittsburgh 12, Pa.

• • •

INSTRUMENT ENGINEER. Graduate E. E., M. E. or Pet. E. Experience 5 to 10 years in refinery instrumentation including a minimum of one year with fluid catalytic cracking units. To take responsible charge of refinery instrumentation activities under general supervision of Chief Engineer, including supervision of approximately 3 instrument repairmen. Age limit, 40 years. Location—Oklahoma. Box 243.

ELECTRONICS ENGINEER. University graduate (E. E.) with 3 or more years experience in circuit design. Unusual opportunity with growing consulting engineering firm. Location—Detroit, Mich. Box 244.

INSTRUMENT ENGINEER. Young graduate engineer with some experience in instrumentation for chemical process control. The position is in an engineering department. Work will consist principally in design of control systems for various present and projected operations related to manufacture of heavy chemicals such as soda ash, caustic soda and chlorine. Box 245.

CHEMICAL ENGINEER. 28 to 32 years. For editorial writing on "Chemical Processing Preview." Should have 4 or 5 years experience in chemical plant operation. Able to write clearly and concisely. Salary open. Box 246.

INSTRUMENT FOREMAN. Must have good theoretical background and capable of supervising men. Must be thoroughly qualified by experience in servicing of industrial process instrumentation. Should be familiar with all types of meters and controllers, vacuum tube circuit of all types and ability to do special work in fundamental physical measurements. Able to read blueprints and flow sheets, knowledge of automatic control theory and well versed in measurement and control principals on electrical and pneumatic instruments and auxiliaries. At least ten years experience along these lines and excellent recommendations required. Location—New Jersey. Box 247.

INSTRUMENT MECHANICS. Several openings for instrument maintenance, repair and calibration mechanics with U. S. Bureau of Mines, Office of Synthetic Fuels, Louisiana, Mo. Write for necessary forms. Box 248.

INSTRUMENT SALES REPRESENTATIVES. To handle sale of tension meters and automatic tension controllers for checking and controlling the tension of yarns, wires, cables rubber threads, and other filamentous materials. Domestic and foreign representation wanted. Good commission. This is an outstanding opportunity for sales engineers well introduced in the textile, wire and rubber industries. Box 249.

SALES REPRESENTATIVE wanted for new, but proven impact recorder. Recorder is used wherever damage can occur to merchandise in movement. Instrument records impact, shock or jar from any direction in connection with a time element. Recorder is either placed with merchandise or used as a package by itself. Small in size and weight. Applicable fields now using unit consists of department stores, refrigerators, stoves, appliances, bottles, pottery, fruit and vegetables, trucks, railroad, etc. National distribution is being set up. Either straight commission or distributorship available. Box 250.

MANUFACTURERS AGENTS. To represent a complete line of electrical instruments and pyrometers. Several good territories now available. Box 251.

INSTRUMENT ENGINEER. Graduate electrical engineer 28-35 years of age. Must have ability to design and develop automotive, industrial and aviation type electro-mechanical indicating instruments. Approximately 10 years experience on small mechanisms with at least 5 years on instruments is desirable. Position entails some customer contact work. Apply in detail with recent photograph attached to Box 252.

Drs. Beckman and Thomas Speak at SAMA Luncheon

The Annual Luncheon of September 14th, at the Hotel Jefferson sponsored by the Scientific Apparatus Makers Association was attended by 150 representatives of members and exhibitors.

Dr. A. O. Beckman, President, National Technical Laboratories, South Pasadena, Calif., recently returned from Europe, reported on the extent to which scientific instrument production in Europe has recovered since the war. The market in that area for the high quality instruments produced in the United States was discussed. Dr. Beckman stated that the lack of components hampers instrument designers abroad and that many were copying American designs.

Dr. Charles A. Thomas, Executive Vice - President, Monsanto Chemical Company, St. Louis, discussed what the instrument user expects from the manufacturers. Dr. Thomas, President last year of the American Chemical Society, has had a wide experience with a great variety of laboratory and industrial instruments.

During the last war, he was one of the principal scientists engaged in the development of atomic bombs and catapult rockets. Here scientific instruments played a tremendously important role in making it possible to adapt unbelievably close tolerances maintained in the research laboratory to industrial processing methods.

Dr. Thomas stated that instrumentation represents from 8 to 15 percent of the capital cost, that many plants would not operate if they were not controlled by instruments.

Section Secretaries, Meeting Data and Programs

ALBUQUERQUE
E. R. Deeter, Eng. Dept., University of California, Los Alamos Scientific Laboratory, P.O. Box 5800, Albuquerque, N. M.

AKRON
Fred Appel, 932 Columbia Ct., Barberton, Ohio.
Fourth Tuesday, Meeting at 8:00 P. M.

ARUBA
A. S. MacNutt, c/o Lago Oil & Transport Co., Ltd., Aruba, N.W.I.
First Tuesday, Meeting at 7:15 P. M.

ATLANTA
H. Kockritz, Fischer & Porter Co., 84 Peachtree St., Atlanta, Ga.
Fourth Monday, Meeting at 7:45 P. M.

BALTIMORE
F. Donahue, Maryland Glass Corp., Mt. Winans, Baltimore, Md.
Second Friday.

BATON ROUGE
James H. Simpson, 3647 Gladiola, Baton Rouge, La.

BOSTON
C. J. Nazzaro, 456 Central Avenue, Milton 87, Mass.
Last Wednesday, Dinner at 6:00 P.M., Meeting at 7:00 P.M.

CALIFORNIA
D. D. Taylor, 234 E. Colorado, Pasadena 1, Calif.
First Tuesday, Dinner at 6:30 P.M.

CENTRAL ILLINOIS
H. F. Lange, 2101 W. Glen Avenue, Peoria 5, Ill.
First Wednesday, Dinner at 6:30 P.M., Meeting at 7:30 P.M.

CENTRAL INDIANA
H. F. Coffey, 110 G Nelson Ave., Tyndall Towne, Indianapolis, Ind.
First Tuesday, Meeting at 7:30 P. M.

CHARLESTON
Albert H. Hix, 1529 B Dixie St., Charleston 1, W. Va.
First Monday, Meeting at 8:00 P.M.

CHICAGO
Floyd E. Ertaman, Rm. 1420 Fisher Bldg., 343 S. Dearborn St., Chicago, Ill.
First Monday, Dinner at 6:30 P.M., Meeting at 8:00 P. M.
November 1, United Airlines Auditorium (5959 S. Cicero Ave.), "Aircraft Instrumentation", R. D. Kelly (United Air Lines), Dinner in Cloud Room, Chicago Municipal Airport. Ladies Invited
November 15, Western Society of Engineers (84 E. Randolph St.) "Instrumentation at 'Operations Crossroads'." Speaker to be announced. Regular dinner.

CHINA LAKE
A. G. DeBell, U. S. Naval Ordnance, Test Sta., China Lake, Calif.

CINCINNATI
Edward H. Muhleisen, 320 Durrell Ave., Cincinnati 15, Ohio
Third Friday, Meeting at 8:00 P.M.

CLEVELAND
R. M. Woodside, Brown Instrument Div., Minneapolis-Honeywell Reg. Co., 5005 Euclid Ave., Cleveland 5, Ohio
Fourth Wednesday, Dinner at 6:30 P.M., Meeting at 8:00 P.M.

COLUMBUS
Orval Linebrink, c/o Battelle Memorial Institute, 505 King Ave., Columbus, Ohio

CUMBERLAND
Clyde Babst, P.O. Box 447, Cumberland, Md.
Tuesday after Fourth Monday, Dinner at 6:30 P.M., Meeting at 8:00 P.M.

DETROIT
Seymour Sterling, 13331 Linwood, Detroit, Mich.
Third Tuesday.

EASTERN NEW YORK
J. M. Wilsey, c/o General Engineering & Consulting Lab., General Electric Company, Schenectady, N. Y.
First Tuesday, Dinner at 6:30 P.M., Meeting at 8:00 P.M.

GULF COAST
A. E. Bunn, 2237 North St., Beaumont, Texas
Third Tuesday.

HOUSTON
E. E. Kleir, 2518 S. Blvd., Houston 6, Texas
Last Monday, Meeting at 8:00 P. M.

KANSAS CITY
Lewell F. Spies, c/o J. F. Pritchard & Co., 908 Grand Ave., Kansas City, Mo.
Last Tuesday, Dinner at 6:30 P. M., Meeting at 7:30 P. M.

LOUISVILLE
H. C. Schermus, 980 Palarka Rd., Louisville, Ky.
Fourth Tuesday, Meeting at 8:00 P.M.

MONTREAL
L. J. Mizuhara, Monsanto (Canada) Ltd., 425 St. Patrick St., Ville LaSalle, Quebec, Canada
Last Monday, Meeting at 8:00 P.M.

NEW JERSEY
W. D. Archibald, 605 Westminster Ave., Elizabeth 3, N. J.
First Tuesday, Dinner at 6:00 P.M.

NEW ORLEANS
W. H. Haney, 2927 Music Avenue, New Orleans, La.
No Regular Date, Meeting at 8:00 P.M.

NEW YORK
Norman J. Cherry, Merrick, L. I., N. Y.
Last Monday, Dinner at 6:30 P.M., Meeting at 8:00 P.M.
Special Program Series—Pressure Measurement; November 14—Flow Measurement; December 12—Density Measurement; January 16—B.T.U. Measurement.

NIAGARA FRONTIER
Mrs. James L. Martin, 697 Potomac Ave., Buffalo 9, N. Y.
Fourth Monday, Dinner at 6:15 P.M., Meeting at 8:00 P.M.

NORTH TEXAS
R. E. Byers, 6000 Lemmon Ave., Dallas 9, Texas

NORTHERN CALIFORNIA
M. A. Dimmick, c/o Mare Island Naval Yard, Mare Island, San Francisco, Calif.

NORTHERN INDIANA
J. Baum Beckman, 547 N. Waller Ave., Chicago 44, Ill.
Third Wednesday, Dinner at 6:30 P.M., Meeting at 7:30 P. M.

OAK RIDGE
John H. Clark, 138 Clayton Hall, Oakridge, Tenn.
First Wednesday, Dinner at 6:30 P.M., Meeting at 7.30 P. M.

ONTARIO
John W. Huether, 311 Southerland Dr., Leaside, Ontario, Canada
Third Thursday, Dinner at 6:45 P.M.

PHILADELPHIA
C. W. Wood, 6908 Market St., Upper Darby, Pa.
Third Wednesday, Meeting at 8:00 P.M.

PITTSBURGH
Miss Louise Suckfield, P.O. Box 2038, Pittsburgh 30, Pa.
Fourth Monday, Dinner at 6:30 P.M., Meeting at 8:00 P.M.

October 24, Roosevelt Hotel, "Use of Ratio Function in Automatic Control with Analog Demonstration of Process Control Effects" V. V. Tivy (Foxboro Co.). Regional Meeting—Afternoon trips to Gulf Res. & Dev. Labs., H. J. Heinz Co., Jones & Laughlin Strip Mill, Westinghouse Electric Analog Computer—Social hour and dinner.

PRESQUE ISLE
Edwin P. Schuwerk, 445½ Halley St., L. P. Erie, Pa.
Fourth Tuesday, Meeting at 8:00 P.M.
October 25, Joint ASME, "Three Hundred Years of Vibration Engineering," Dr. S. Zand, Vice President, Lord Mfg. Co.

RICHLAND
R. S. Hammond, 402 Abbott, Richland, Washington
Second Wednesday, Meeting at 7:30 P.M.

ROCHESTER
R. C. Swartz, Jr., 1201 Granite Bldg., Rochester 4, N. Y.
Fourth Tuesday, Meeting at 8:00 P.M.

ST. LOUIS
W. G. Lee, 4710 Delor St., St. Louis 16, Mo.
First Wednesday, Meeting at 8:00 P.M.

SARNIA
Fred T. Yarke, 140 St. Clair St., Point Edward, Ontario, Canada
Second Friday.

SOUTH BEND
Sam M. Rouse, 436 Moccasin Ave., Buchanan, Mich.
First Thursday, Dinner at 6:30 P.M., Meeting at 7:30 P.M.

SOUTH MICHIGAN
Homer Kuiper, 2517 Hillsdale, Kalamazoo, Mich.
Second Wednesday, Dinner at 6:30 P.M., Meeting at 8:00 P.M.

SOUTH TEXAS
H. C. Givens, La Gloria Corp., P.O. 637, Farfurrias, Texas
First Tuesday, Meeting at 7:30 P.M.

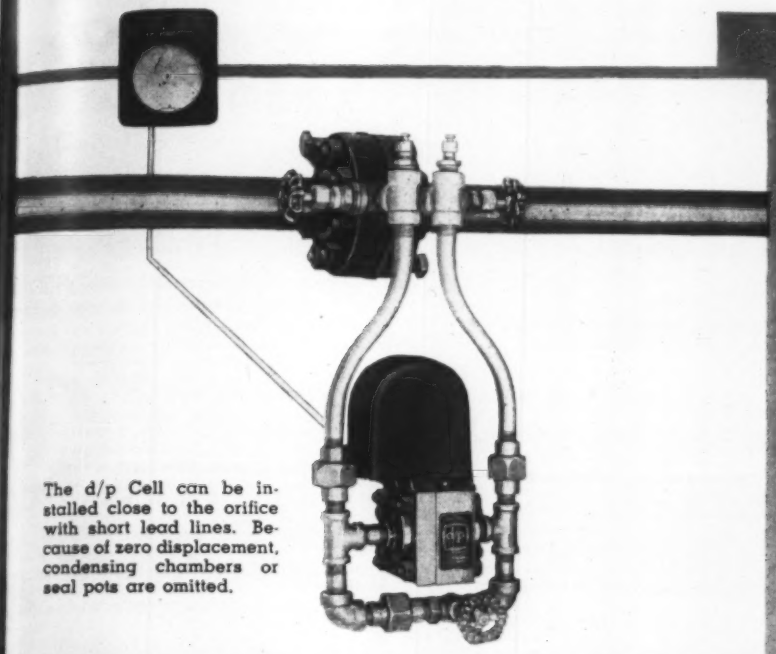
TENNESSEE
N. M. Taylor, 16 Edgewood, Kingsport, Tenn.
No definite night, Dinner at 7:00 P.M., Meeting at 8:00 P.M.

TULSA
C. R. Horton, 8211 E. 7th, Tulsa, Oklahoma
First Monday, Meeting at 7:30 P.M.

TWIN CITIES
Alden Hine, c/o Giesika & Pinkney, 552 Plymouth Ave., 6th & Hennepin Ave., Minneapolis 8, Minn.
Fourth Tuesday, Dinner at 6:30 P.M.

WASHINGTON
Edwin G. Brown, c/o American Instrument Co., 8010-20 Georgia Ave., Silver Springs, Md.
Third Monday, Meeting at 7:30 P.M.

WAYNE COUNTY
Robert Karr, 2455 Biddle Ave., Wyandotte, Michigan
Third Monday, Dinner at 6:30 P.M., Meeting at 8:00 P.M.



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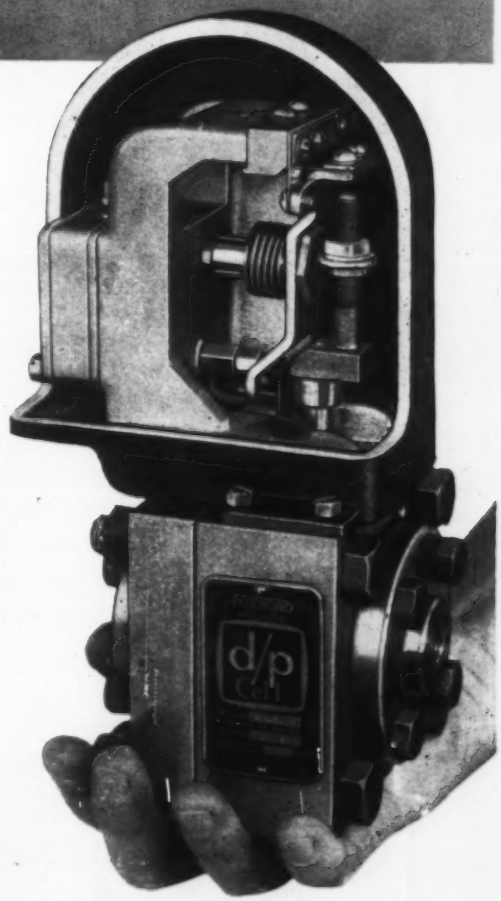

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Manufacturers' New Literature

In this department we report new literature pertaining to Instrumentation, received from the manufacturers. We urge readers to request ONLY those bulletins which will be of value to them. Use the Postage-free Order Card on Page 971.

R-511 DIAPHRAGM SEALS FOR PRESSURE INSTRUMENTS. Three sheets illustrates Example No. 3 Mercoid pressure switch type DA531, for "M & G Diaphragm Seal File Folder."—Mansfield & Green, 1051 Power Ave., Cleveland 14, Ohio.

R-512 INDUSTRIAL ANALYZER. 2-page bulletin describes and illustrates maker's "Model 247" analyzer; gives dimensions, characteristics, specifications, possible uses.—Instrument Laboratories, Chicago 10, Illinois.

R-513 ALARM SILENCER. 2-page Bulletin No. 7400 illustrates and describes maker's "Autocon Model ABS" alarm silencer; lists characteristics, possible applications, operation description.—Automatic Control Co., 1005 University Ave., St. Paul 4, Minn.

R-514 INSULATION-RESISTANCE MEASUREMENT. 4-page Bulletin No. 209 describes and illustrates maker's "Vibrotest" testing instruments; lists capacities, specifications, advantages.—Associated Research, Inc., 3758 W. Belmont Ave., Chicago 18, Ill.

R-515 INDICATING GAGES. 4-page booklet describes and illustrates maker's "Superbronze" non-corrosive indicating gages; lists types, ranges, construction details.—Star Brass Div., Williams & Hussey Machine Co., Wilton, N. H.

R-516 LEVEL CONTROL. 4-page booklet Bulletin 149 describes and illustrates maker's "Gagetron" level measurement or control instrument; contains drawings of operation, typical installations. — Instruments, Inc., Wright Bldg., Tulsa, Oklahoma.

R-517 FLOW CONTROL. 8-page Bulletin No. 103 illustrates and describes maker's "Cono-Controls," instruments for the control of flow; contains specifications, characteristics.—Conoflow Corp., 2100 Arch St., Philadelphia 3, Pa.

R-518 DISK THERMOSTATS. 2-page Bulletin F-2001 describes and illustrates maker's "Type M" bi-metal disk thermostats; contains schematic drawing, construction data, possible uses.—Stevens Mfg. Co., Mansfield, Ohio.

R-519 GAGE TESTERS. 4-page bulletin describes and illustrates maker's dead-weight gage testers; gives construction details, operating instructions.—Star Brass Div., Williams & Hussey Machine Co., Wilton, N. H.

R-520 ANALYZER. 2-page bulletin describes and pictures maker's "Model 102" industrial analyzer; lists specifications, characteristics, applications.—Instrument Laboratories, Chicago 10, Ill.

R-521 ELECTRICAL INSTRUMENTS. 50-page Catalog No. 16 describes and illustrates maker's electrical instruments; lists dimensions, specifications; shows production procedure. — Simpson Electric Co., 5200-18 W. McKinzie St., Chicago 44, Ill.

R-522 "THE C-D CAPACITOR." 16-page Vol. 14, No. 7 issue of this house organ features an article titled "The How and Why of Vibrators"; contains regular "The Radio Trading Post" section.—Cornell-Dubilier Electric Corp., Hamilton Blvd., South Plainfield, N. J.

R-523 "TAYLOR TECHNOLOGY." 28-page Vol. 2, No. 1, issue of this house organ features articles titled "Automatic Controls for Processing Firestone Velon," "The Pitot-Venturi," and others.—Taylor Instrument Cos., Rochester 1, N. Y.

R-524 PIPE MARKERS. 4-page bulletin describes and illustrates maker's self-adhesive "Quick Label" pipe markers; contains stock lists, uses.—W. H. Brady Co., Dept. 31, 815 N. Third St., Milwaukee 3, Wis.

R-525 RADIO-TELEVISION SERVICE. 16-page booklet illustrates and describes functions of service men in maintaining good reception on TV and radio.—Sprague Products Co., North Adams, Mass.

R-526 PRECISION SWITCHES. 2-page bulletin describes and illustrates 16 mm. color and sound motion picture on maker's precision switches.—Micro Switch, Freeport, Ill.

R-527 HEAVY-DUTY LIMIT SWITCH. 2-page Temporary Data Sheet 51 describes and illustrates maker's heavy-duty precision limit switch for industrial use; lists features, dimensions, uses.—Micro Switch, Freeport, Ill.

R-528 LOW-FREQUENCY OSCILLOSCOPES. 8-page bulletin pictures and describes maker's "Models L-22 and L-24" low-frequency cathode-ray oscilloscopes; lists design features, specifications, construction.—Smith & Stone Ltd., Georgetown, Ontario, Can.

R-529 MERCURY RELAYS. 16-page Catalog No. 14 describes and illustrates maker's mercury relays, also thermoregulators, thermostats, etc.; lists dimensions, specifications.—H-B Instrument Co., 2633 Trenton Ave., Philadelphia, Pa.

R-530 TEMPERATURE RECORDERS. 24-page bulletin describes and illustrates maker's "Minicorder" temperature and pressure recorders, contains charts, diagrams; lists specifications, uses.—The Dickson Co., 7420 Woodlawn Ave., Chicago 19, Ill.

R-531 POWER CONTROL EQUIPMENT. 16-page Catalog PL-100 pictures and discusses maker's gage boards, panel boards, switchboards, etc.; describes typical problems.—Taller & Cooper, Inc., 75 Front St., Brooklyn 1, N. Y.

R-532 "S. L. INSTRUMENT NOTES." 4-page No. 9 issue of this house organ contains article titled "Design Parameters for Linear Accelerometers."—Statham Laboratories, 9328 Santa Monica Blvd., Beverly Hills, Calif.

R-533 MICA CAPACITORS. 2-page Bulletin NB-134 illustrates and describes maker's "Feed-thru" mica capacitors; lists dimensions, outstanding features, uses.—Cornell-Dubilier, South Plainfield, N. J.

R-534 SCIENTIFIC INSTRUMENT LITERATURE INDEX. 4-page general index lists bulletins describing all of maker's instruments.—Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill.

R-535 LINEAR COMPARATOR. 4-page Bulletin 170-49 describes and illustrates maker's "Model M1201-30B" linear comparator; discusses construction, outstanding features. — Gaertner Scientific Corp., 1201 Wrightwood Ave., Chicago 14, Ill.

R-536 HIGH-SPEED DIRECT RECORDER. 8-page bulletin describes and illustrates maker's "Dynograph Recording Assembly"; discusses amplifier, power supply for assembly—

ner Electronics Inc., 5320 N. Kedzie Ave., icago 25, Ill.

R-537 SPECTROGRAM COMPARATOR. 2-e Bulletin 168-49 illustrates and describes ker's "Model F1176" spectrogram comparator measuring spectrographic plates and other rec-s; lists dimensions, characteristics.—Gaertner entific Corp., 1201 Wrightwood Ave., Chicago Ill.

R-538 TENSION METER. 2-page bulletin scribes and illustrates maker's instrument for ecking yarn tensions; lists features, uses.—rl Instrument Co., Harvard, Mass.

R-539 ELECTRONIC EQUIPMENT. 20-ge booklet pictures and discusses maker's sound stems, recorders, aviation radio, time interval unter, electronic sealer, etc.—RCA Victor Div., adio Corporation of America, Camden, N. J.

R-540 SMOKE INDICATOR. 4-page Bul-tin SR-1006 describes and illustrates maker's Type SR-146-C" photo-electronic smoke indi-ator; lists uses, exclusive features, accessories.—cNeill Engineering Co., 4057 W. Van Buren St., hicago 24, Ill.

R-541 RECORDING THERMOMETERS. 4-ge bulletin illustrates and describes maker's re-ording and indicating thermometer; contains pecifications, chart and dial ranges.—Instrument nd Gage Div., The Electric Auto-Lite Co., To-edo 1, Ohio.

R-542 INDUSTRIAL INSTRUMENTS. 4-age Bulletin W1811 illustrates and describes aker's stock instruments for immediate delivery; ists specifications, applications.—The Bristol Co., Waterbury 91, Conn.

R-543 RECORDING THERMOMETER. 4-age Bulletin T842 describes and illustrates mak-r's "Model 169" portable traveling-oven recording hermometer; lists dimensions, specifications, ses.—The Bristol Co., Waterbury 91, Conn.

R-544 FLOW REGULATOR. 4-page bulletin escribes and illustrates maker's regulator for con-rolling fluid flow independently of pressure; dis-usses operation, installation, capacities.—W. A. Kates Co., 430 Waukegan Rd., Deerfield, Ill.

R-545 VOLTAGE-DIVIDING RHEOSTAT. 12-page Bulletin 104A illustrates and describes aker's "Beckman Helipot" voltage dividers; lists onstruction features, specifications, stock values. —The Helipot Corp., 1011 Mission St., South Pasadena, Calif.

R-546 RECORDING OXYGEN ANALYZ-ER. 8-page Bulletin 103 describes and illustrates aker's "Model G-2" recording oxygen analyzer; ists applications, outstanding features, specifica-ions.—Arnold O. Beckman Inc., 11 W. State St., Pasadena 2, Calif.

R-547 WEATHER CONTROL. 12-page Technical Bulletin No. 2 describes maker's sys-tems for heat control; discusses apartment, school and office systems, utilizing diagramatic charts.—Sarcotherm Controls, Inc., Empire State Bldg., New York 1, N. Y.

R-548 VISCOSITY DETERMINATION. 8-page bulletin pictures and describes maker's "Synchro-Lectric Viscometer"; lists outstanding advantages, specifications, operations.—Brookfield Engineering Laboratories Inc., Porter St., Stough-ton, Mass.

R-549 "TRACERLOG." 16-page No. 20 issue of this house organ features articles on maker's "Model SM-3 Tracerlab Beta Gages" and others. —Tracerlab Inc., 55 Oliver St., Boston 10, Mass.

R-550 CONTROLLED-VOLUME PUMP. 4-page Bulletin No. 649 illustrates and describes maker's "Constametric" controlled-volume pump; contains charts, cutaways; lists applications, ca-pacities, pressures, engineering data.—Milton Roy Co., 1300 E. Mermaid Lane, Philadelphia 18, Pa.

R-551 GAGE ILLUMINATORS. 2-page bul-letin illustrates and discusses maker's gage illum-inators; describes features, installation, sizes.—Ferguson Gage & Valve Co., 80 Fellsway, Somer-ville 45, Mass.

R-552 PYROMETER CONTROLLERS. 2-page Bulletin PC-1 describes and illustrates mak-

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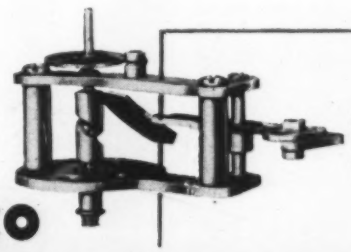

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er's "Panelmount Capacitrol" series of indicating pyrometer controllers; lists special features, types, specifications.—Wheelco Instruments Co., Chicago 7, Ill.

R-553 CABINET TYPE PANELS. 4-page Bulletin P1-1 illustrates and describes maker's cabinet type instrument panels; contains break-down drawings of cabinets, specifications.—Wheelco Instruments Co., Chicago 7, Ill.

R-554 METAL FABRICATION. 4-page bulletin illustrates maker's sheet metal products such as instrument panels, oscillator boxes, electronic boxes, etc.—S. Walter Co., 1400 Atlantic Ave., Brooklyn 16, N. Y.

R-555 OSCILLOGRAPHS. 4-page bulletin describes and illustrates maker's "Model R028" dual recorder and "Model OA2" dual amplifier; lists construction specifications, accessories.—Rahm Instruments Inc., 12 W. Broadway, New York 7, N. Y.

R-556 ABSOLUTE PRESSURE GAGE. 8-page Bulletin G620 describes and illustrates maker's "Series 500 Recording Absolute Pressure Gages"; ranges as low as 0 to 20 mm. mercury; lists special features, chart ranges, applications.—The Bristol Co., Waterbury 91, Conn.

R-557 VACUUM THERMOCOUPLES. 4-page Bulletin V24 describes maker's "Type F" radiation vacuum thermocouples; discusses construction, uses, dimensions, characteristics.—Fischer Electrical Instrument Co., 109 E. 184th St., New York 53, N. Y.

R-558 MOISTURE CONTROL. 12-page booklet discusses the moisture in the atmosphere, titled "The World Is Sopping Wet!"; describes maker's "Lectrodryer" moisture controller; includes pictures, graphs.—Pittsburgh Lectrodryer Corp., Dept. E.G., P.O. Box 1766, Pittsburgh 30, Pa.

R-559 AUTOMATIC FILLING MACHINES. 4-page bulletin describes and illustrates maker's "Gemware" aseptic filling machines for pharmaceutical laboratories; discusses uses, operation, control.—G. M. Manufacturing Co., 50 W. Third St., New York 12, N. Y.

R-560 ENGINE INSTRUMENTS. 30-page Catalog No. 646 illustrates and describes maker's safety controllers, alarm systems, special indicator systems, etc., for internal-combustion engines.—Viking Instruments, Inc., East Haddam, Conn.

R-561 MIDGET ELECTRICAL INSTRUMENTS. 4-page bulletin pictures and describes maker's midget electrical instruments; lists exclusive features, applications, general data, basic movements.—International Instruments Inc., 33 East St., New Haven 11, Conn.

R-562 HIGH-SPEED CHRONOSCOPE. 4-page Bulletin No. 100 describes and illustrates maker's high-speed chronoscope for measuring short time intervals; lists specifications; discusses uses.—American Chronoscope Corp., 316 West First St., Mt. Vernon, N. Y.

R-563 SWITCHBOARD CONNECTORS. 8-page Bulletin LS4-1248 illustrates and describes maker's laboratory and switchboard connectors; discusses use, construction; lists types with specifications, diagrams.—Cannon Electric Development Co., 3209 Humboldt St., Los Angeles 31, Calif.

R-564 MERCURY STILL. 2-page Bulletin 170 describes and illustrates maker's automatic mercury still; contains diagram, specifications, special features.—Eberbach & Son Co., Ann Arbor, Mich.

R-565—ELECTRICAL MEASURING INSTRUMENTS. 136-page Catalog No. 60 describes and illustrates maker's line of electrical measuring instruments; contains index, ordering instructions. — Sensitive Research Instrument Corp., Mt. Vernon, N. Y.

R-566 GEIGER COUNTER. 2-page bulletin pictures and describes maker's "Sniffer" for locating radioactive minerals; lists features, instructions.—Nuclear Instrument & Chemical Corp., 223-233 W. Erie St., Chicago 10, Ill.

R-567 WIDE-RANGE OSCILLATOR. 4-page bulletin illustrates and describes maker's

odel M" low-distortion wide-range oscillator; s specifications, uses, schematic drawing.—thwestern Industrial Electronic Co., 2831 Post Rd., Houston, Texas.

-568 SPECTROGRAPH SOURCE UNIT. ge Bulletin No. 300 describes and illustrates er's "Spec-power" power supply; gives speci-ions, drawings.—National Spectrographic Lab-ories Inc., 6300 Euclid Ave., Cleveland 3, Ohio.

-569 DRY LUBRICANT. 4-page Bulletin 52 describes maker's "Molykote" dry lubri-t and anti-seizing compound for extreme bear-pressures; discusses applications, corrosion, bility.—The Alpha Corp., Greenwich, Conn.

R-570 "WHAT'S NEW FOR THE LABOR-ORY." 16-page No. 8 issue of this house organ describes and illustrates types of laboratory paratus; contains cumulative 1949 index.— Sci-ific Glass Apparatus Co., Inc., Bloomfield, N. J.

R-571 PRESSURE GAGES. 2-page Bulletin 250 illustrates and describes maker's "Magne-ic" gages for checking air movement in fans, wers, furnaces, etc.; discusses construction, op-ation, uses.—F. W. Dwyer Mfg. Co., 317 S. estern Ave., Chicago 12, Ill.

R-572 PHOTOCELLS. 4-page Bulletin PC-0 decribes and illustrates maker's line of selen-m self-generating photocells; contains diagrams, rves, etc.; discusses construction, characteris-s, applications.—International Rectifier Corp., 09 S. Victoria Ave., Los Angeles 43, Calif.

R-573 MECHANICAL PRESSURE GAGE. -page bulletin illustrates and describes maker's echanical pressure gage; lists special features, mensions, applications.—W. C. Dillon & Co., c., 5410 W. Harrison St., Chicago 44, Ill.

R-574 INFRARED GAS ANALYZER. 8-ge Bulletin XXXI describes and illustrates aker's infrared absorption type automatic re-rding gas analyzer; lists advantages; discusses inciple, operation, characteristics, specifications. —Baird Associates, Inc., 33 University Rd., Cam-ridge 38, Mass.

R-575 PREPARATIVE CENTRIFUGE. 4-ge bulletin describes and illustrates maker's Model L Spinco" 40,000-rpm. refrigerated vac-m centrifuge; gives dimensions, specifications; iscusses operation, uses.—Specialized Instru-ents Corp., Belmont, Calif.

R-576 GAGE ACCESSORIES. 4-page bulle-n illustrates and describes maker's optional fea-res and accessories for gages and valves.— erguson Gage & Valve Co., 80 Fellsway, Somer-ille 45, Mass.

R-577 PANEL INSTRUMENTS. 2-page bul-tin describes and illustrates maker's "Model A3 Group and Model 6A3 Group" panel instru-

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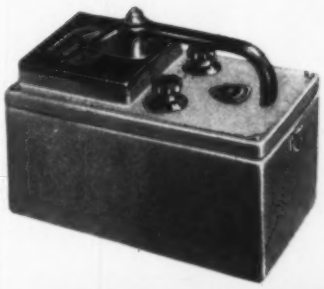
ments; lists specifications, characteristics.—Cole Instrument Co., 1320 S. Grand Ave., Los Angeles 5, Calif.

R-578 LARGE OPTICAL POINTER-TYPE INSTRUMENTS. 2-page bulletin illustrates and describes maker's "Model 18A22 Group" large optical pointer-type instruments; discusses and pictures "Model 110, 111" flexible shaft lance type pyrometer.—Cole Instrument Co., 1320 S. Grand Ave., Los Angeles 15, Calif.

R-579 TIMERS. 2-page bulletin pictures and describes maker's "Type 140X and 120X Robo-

Keleket Gamma Survey Meter



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